

PENOBSCOT RIVER FLOOD CONTROL

INDIAN ISLAND

LOCAL PROTECTION PROJECT

OLD TOWN, MAINE

DETAILED PROJECT REPORT



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JANUARY 1974

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

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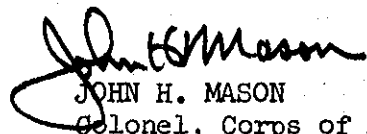
31 January 1974

SUBJECT: Indian Island Local Flood Protection, Penobscot River
Old Town, Maine, Detailed Project Report

HQDA (DAEN-CWP-E)
WASH DC 20314

1. In accordance with ER 1165-2-12 dated 1 April 1965 and letter from General Morris dated 26 September 1973 (subject: Small Projects Programs), there are submitted herewith for review and approval, twelve (12) final copies of the subject report. An environmental assessment has been prepared in lieu of an environmental impact statement as the proposed project at Indian Island will have a beneficial **effect** on the environment and there are no controversial issues involved. Twelve (12) copies of the environmental assessment are inclosed with the Detailed Project Reports as separate attachments.
2. Appendix A contains letters of preliminary assurances from the Commissioner of the Maine Department of Indian Affairs and the Tribal Governor of the Penobscot Indians, indicating their intention and ability to meet the requirements of local cooperation. Formal assurances of participation will be obtained pending approval and authorization of final design for the project.
3. Plans and specifications will be prepared substantially in accordance with this report, as approved. Funds will be required in the amount of \$16,000 for preparation of plans and specifications and \$89,000 for construction.

Incl (12 cys)
as


JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

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TABLE OF CONTENTS

| <u>Paragraph</u> | <u>Title</u> | <u>Page</u> |
|------------------|--|-------------|
| | A. PERTINENT DATA | 1 |
| | B. PROJECT AUTHORITY | 2 |
| | C. SCOPE OF DETAILED PROJECT REPORT | 3 |
| 1 | Scope | 3 |
| 2 | Topographic Surveys and Field Investigations | 3 |
| 3 | Economic Investigations | 3 |
| 4 | Real Estate Studies | 3 |
| 5 | Local Desires and Interest | 4 |
| | D. PRIOR REPORTS | 4 |
| 6 | Reconnaissance Report | 4 |
| | E. DESCRIPTION OF AREA | 4 |
| 7 | General | 4 |
| 8 | Topography and Surficial Geology | 5 |
| 9 | Main River and Tributaries | 5 |
| 10 | Stream Characteristics | 5 |
| 11 | Maps | 6 |
| | F. HYDROLOGY AND HYDRAULIC DESIGN | 6 |
| 12 | Climatology | 6 |
| 13 | Record Floods | 6 |
| 14 | Flood Frequencies | 6 |
| 15 | Project Design Flood | 6 |
| | G. ECONOMIC DEVELOPMENT AND FLOOD DAMAGE | 7 |
| 16 | Economic Base | 7 |
| 17 | Character of Flooded Area and Losses | 12 |
| 18 | Future Development | 13 |
| | H. EXISTING CORPS OF ENGINEER FLOOD CONTROL PROJECTS | 14 |

| <u>Paragraph</u> | <u>Title</u> | <u>Page</u> |
|------------------|--|-------------|
| | I. IMPROVEMENTS BY FEDERAL AND NON-FEDERAL AGENCIES | 15 |
| | J. IMPROVEMENTS DESIRED | 15 |
| | K. FLOOD PROBLEM AND ALTERNATIVES CONSIDERED | 15 |
| 19 | Flood Problem | 15 |
| 20 | Alternatives considered | 16 |
| | L. PROPOSED IMPROVEMENT | 16 |
| 21 | General Description | 16 |
| 22 | Dike | 16 |
| 23 | Drainage | 16 |
| 24 | Relocation of Utilities | 17 |
| 25 | Foundations, Embankments and Materials | 17 |
| 26 | Hydraulic Design | 19 |
| | M. MULTIPLE PURPOSE FEATURES | 19 |
| | N. REAL ESTATE REQUIREMENTS | 19 |
| | O. ESTIMATES OF FIRST COST AND ANNUAL CHARGES | 19 |
| 27 | General | 19 |
| 28 | Basis of Cost Estimates | 20 |
| 29 | Contingencies, Engineering, Supervision and Administration | 20 |
| 30 | Basis of Annual Charges | 20 |
| | P. ESTIMATES OF BENEFITS | 20 |
| | Q. COMPARISON OF BENEFITS AND COSTS | 21 |
| | R. PROJECT FORMULATION AND ECONOMIC JUSTIFICATION | 21 |
| | S. ENVIRONMENTAL STUDIES | 21 |

| <u>Paragraph</u> | <u>Title</u> | <u>Page</u> |
|------------------|--|-------------|
| T. | SCHEDULES FOR DESIGN AND CON- STRUCTION | 21 |
| U. | OPERATION AND MAINTENANCE | 24 |
| V. | LOCAL COOPERATION | 24 |
| W. | COORDINATION WITH OTHER AGENCIES | 24 |
| X. | STATEMENT OF FINDINGS | 25 |
| Y. | CONCLUSIONS | 27 |
| Z. | RECOMMENDATIONS | 27 |

TABLES

| <u>Number</u> | <u>Title</u> | <u>Page</u> |
|---------------|--|-------------|
| 1 | Total Population | 8 |
| 2 | Total Civilian Labor Force | 8 |
| 3 | Median Family Income (1967 Constant Dollars) | 10 |
| 4 | Percent Distribution of Employment by Industry | 11 |
| 5 | Estimates of First Costs and Annual Charges | 22 |

PLATES

| | |
|---|--|
| 1 | General Project Plan |
| 2 | Dike Sections and Plans of Intake and Outfall Structures |

APPENDICES

| | |
|----|------------------------------------|
| A. | LETTERS OF CONCURRENCE AND COMMENT |
| B. | HYDROLOGY AND HYDRAULIC DESIGN |
| C. | DIGEST OF PUBLIC MEETING |
| D. | PRINCIPLES AND STANDARDS |

LOCAL FLOOD PROTECTION PROJECT

PENOBSCOT RIVER

INDIAN ISLAND, OLD TOWN, MAINE

JANUARY 1974

A. PERTINENT DATA

1. Purpose Local Overbank flood control of the Penobscot River
2. Location Penobscot River, Penobscot Indian Reservation, Indian Island, Old Town, Penobscot County, Maine
3. Type of Improvements Two earth dikes (East Dike and West Dike), portable pumps to discharge interior drainage and other appurtenant structures
4. Hydrology

| | |
|-------------------------|-------------------|
| Maximum flood of record | May 1923 |
| Discharge | 103,000 c.f.s. |
| Elevation | 107.3 feet m.s.l. |
| Drainage Area | 7600 square miles |
5. Dike

| | |
|-------------------|---|
| Type | Earth-filled with stone slope protection to top on riverside, top-soil and seeded on land side. |
| Length | East Dike - 580 feet West Dike - 705 feet |
| Top elevation | 110 feet m.s.l. |
| Top width | 12 feet |
| Maximum height | 7 feet |
| Slopes, riverside | 1 on 2 |
| landside | 1 on 4 |

6. Pumps Portable, self-priming, centrifugal pumps, each with a capacity of 2 c.f.s. at a head of 10 feet
7. Gates Two each 18" Flap Gates
18" Shear Gates
8. Principal Quantities
- | | |
|------------------|------------|
| Excavation | 3,100 c.y. |
| Impervious Fill | 4,500 c.y. |
| Gravel Bedding | 1,400 c.y. |
| Stone Protection | 1,600 c.y. |
9. Cost Estimates
- First Costs
- | | |
|-------------|------------------|
| Federal | \$105,000 |
| Non-Federal | 0 |
| Total | <u>\$105,000</u> |
- Annual Costs
- | | |
|-------------|----------------|
| Federal | \$6,316 |
| Non-Federal | 400 |
| Total | <u>\$6,716</u> |
10. Benefits
- | | |
|-------------------------|-------------|
| Average Annual Benefits | \$8,900 |
| Benefit-Cost Ratio | 1.32 to 1.0 |

B. PROJECT AUTHORITY

This Detail Project Report is submitted pursuant to authority contained in Section 205 of the 1948 Flood Control Act, as amended by Public Law 87-874 of the Flood Control Act of 1962 approved 23 October 1962. Further authority is contained in 1st Indorsement, dated 3 May 1972, from the Chief of Engineers to a report, dated 21 March 1972, from the Division Engineer, New England Division, Subject: "Reconnaissance Report, Local Flood Protection, Penobscot River, Old Town, Maine."

C. SCOPE OF DETAILED PROJECT REPORT

1. SCOPE

This Detailed Project Report reviews the general overbank flood problem along the Penobscot River inundating a residential and commercial area located at the southern end of Indian Island in Old Town, Maine. Indian Island, which is the site of the Penobscot Indian Reservation, is susceptible to floods caused by heavy rains in combination with snowmelt. The flood of record occurred in May 1923, while most recently, flooding occurred during April 1973. This report submits a definite project plan of improvement which includes the modification of two temporary earth dikes, constructed during Operation Foresight 1971, and construction of appurtenant structures at the southern end of Indian Island. The existing dikes were constructed during April 1971 in anticipation of imminent flood conditions in the Penobscot River Basin, due to an unusually heavy snow cover. On 30 April 1973 high river stages breached one of the dikes and river flows backed thru drainage pipes inundating several homes. These conditions are shown on the aerial photos included in this report.

2. TOPOGRAPHIC SURVEYS AND FIELD INVESTIGATIONS

A topographic survey of the proposed local protection project, on a scale of 1" = 40' and a contour interval of 2 feet, was made during July 1972. Field reconnaissance investigations to determine foundation conditions and the source of earth, rock and concrete materials were made during November 71.

3. ECONOMIC INVESTIGATIONS

A detailed flood damage survey was conducted in Old Town in June 1973 to determine the extent of damage that would be experienced in a recurrence of record flood stages and the extent of plus stage damages. The survey consisted of a field examination of the project area and personal interviews with local officials as well as property owners affected by flooding.

4. REAL ESTATE STUDIES

Detailed Real Estate investigations were not accomplished for this study. Although lands required for construction at the proposed project are owned individually by members of the Penobscot Indian Tribe and not by the Tribe itself, we have received assurances that the necessary permanent and construction easements will be provided at no cost to the local sponsoring agency. (Maine Dept. of Indian Affairs) Although there will be an encumbrance upon the easement lands, preventing certain usage such as tree planting and excavation, the owners will be able to more fully utilize the land because of the improved aesthetics and flood protection that will be afforded by the project.

5. LOCAL DESIRES AND INTEREST

Close liaison has been maintained with Indian and state officials and other interested parties. Very strong local interest and support of the improvement has been expressed. The desires of local interests are described in Section J. A strong desire for construction and completion of the proposed project has also been expressed by state officials. Preliminary assurances of local cooperation are included in Appendix A. Formal assurance will be required from the State of Maine and the Department of Indian Affairs of the State of Maine.

D. PRIOR REPORTS

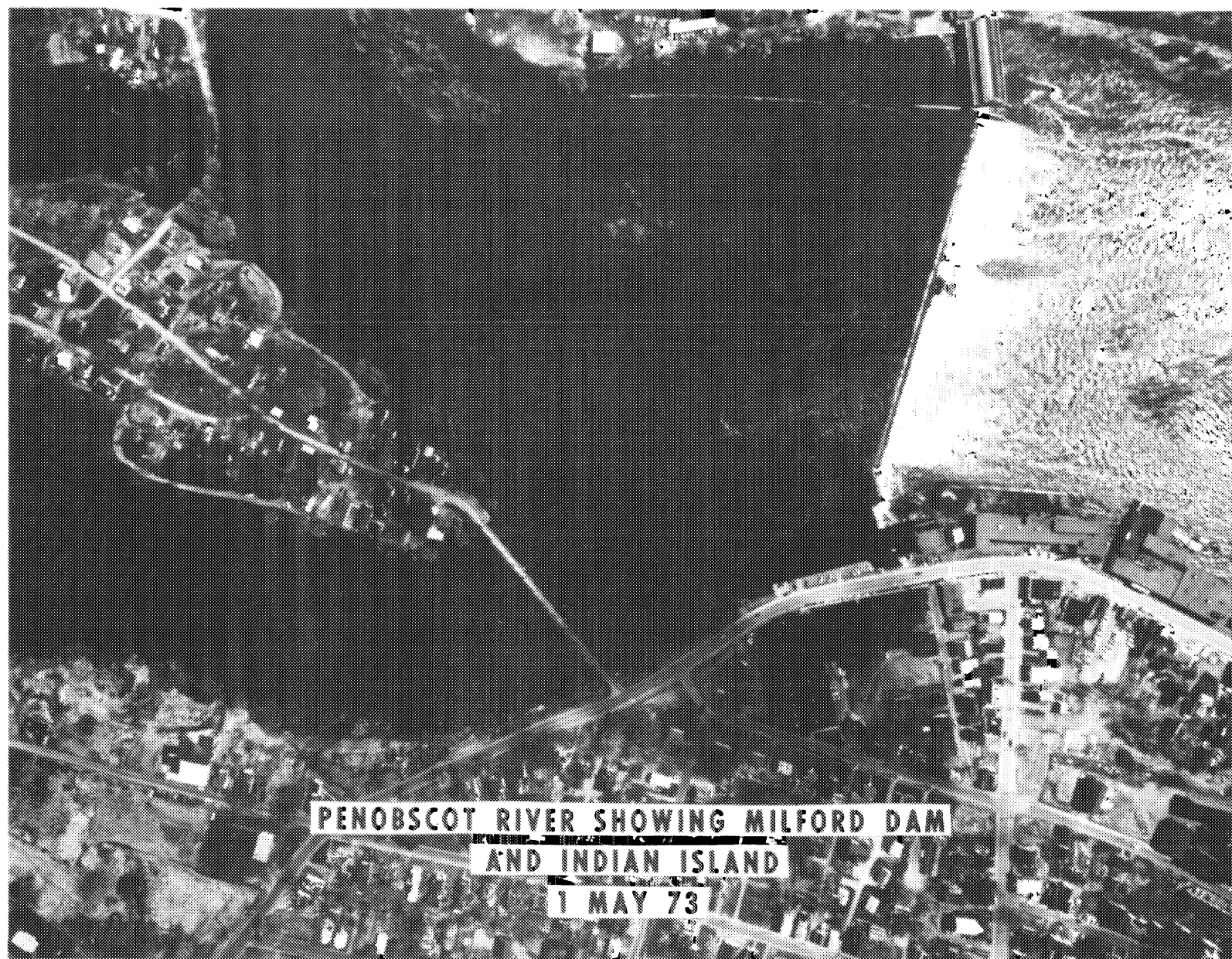
6. RECONNAISSANCE REPORT

In response to requests by local interests and in compliance with ER 1165-2-12, dated 1 April 1965, a reconnaissance report concerning the overbank flood problem at Indian Island in Old Town, Maine, was made. The report stated that modification of two temporary earth dikes, constructed at the southern end of the island during Operation Foresight 1971, into permanent structures would relieve the flooding situation. The reconnaissance report indicated that the project was economically feasible and within the scope of Section 205, Public Law 87-874. It recommended that the New England Division be authorized to prepare a Detailed Project Report. By 1st Indorsement, dated 3 May 1972, the Chief of Engineers authorized preparation of a Detailed Project Report.

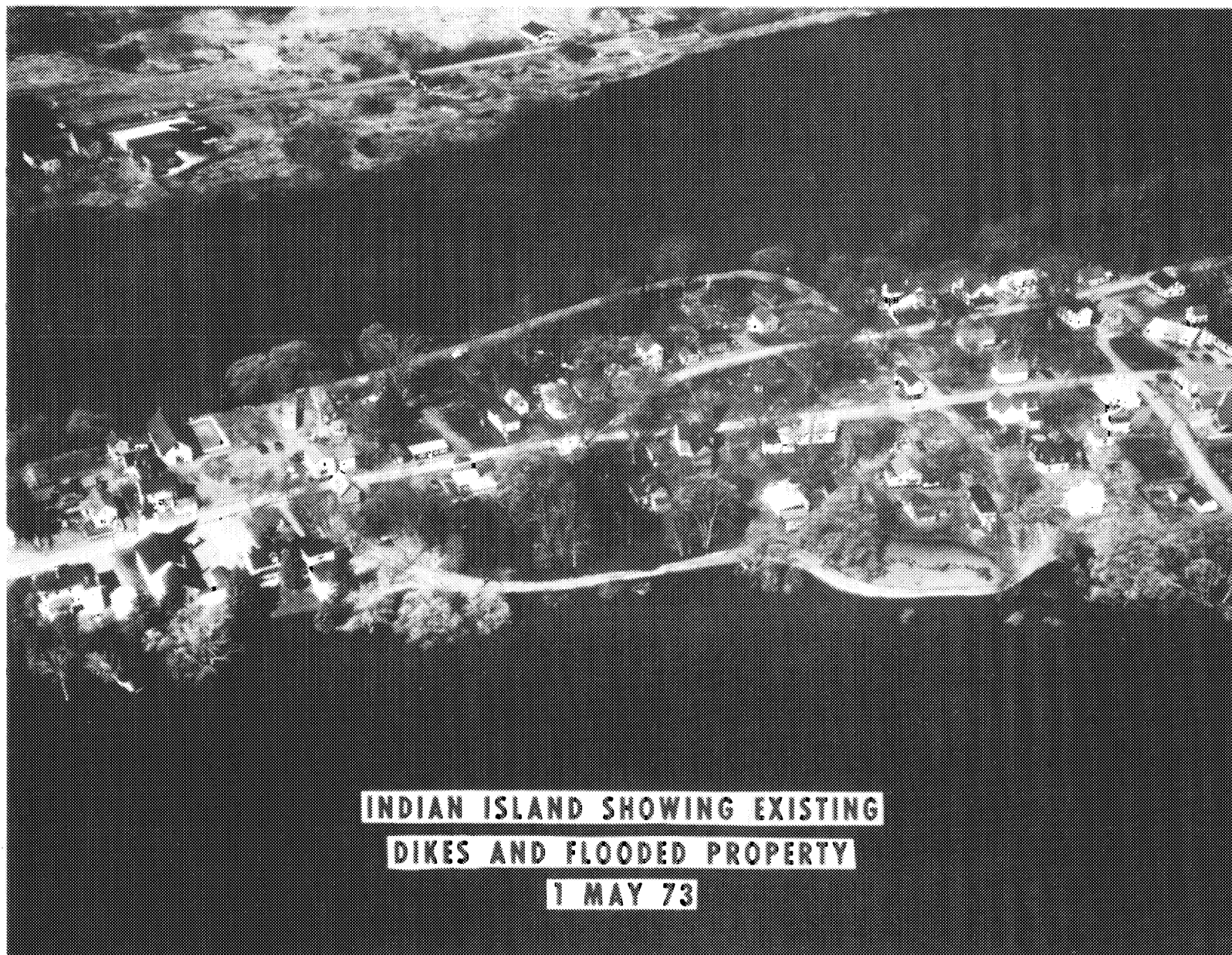
E. DESCRIPTION OF AREA

7. GENERAL

The Penobscot Indian Reservation, known as Indian Island, is located in Old Town, Maine, approximately 14 miles northeast of Bangor, Maine. The island is situated in the Penobscot River and in the pool formed by Milford Dam. This dam is located about 2000 feet downstream of the southern tip of the island and is owned by the Bangor Hydroelectric Company. (See photograph) The Penobscot River Basin is located entirely in the State of Maine between the watersheds of the Saint John River to the north, the St. Croix River to the east and the Kennebec River to the west. The northwestern limit of the watershed forms a part of the boundary between Maine and the Canadian province of Quebec. It is the largest river basin lying wholly within Maine and the second largest in New England, being exceeded only by the Connecticut River Basin.



PENOBSCOT RIVER SHOWING MILFORD DAM
AND INDIAN ISLAND
1 MAY 73



INDIAN ISLAND SHOWING EXISTING
DIKES AND FLOODED PROPERTY
1 MAY 73

8. TOPOGRAPHY AND SURFICIAL GEOLOGY

Indian Island is located within the Bangor lowland of the New England Physiographic Province, an area of low rolling hills rising above wide flat valleys. The Penobscot River at Indian Island flows through a region of low relief with the hills adjacent to the river rising to elevations of 300 to 400 feet m.s.l. The region has been modified by glaciations and the lower portion of the basin by marine invasions. Local monadnocks in the middle reaches of the Penobscot Basin reach elevations of 1,200 to 1,400 feet m.s.l. The bedrock consists principally of Silurian age shales and slates. Indian Island is a rock controlled feature in the Penobscot River comprised primarily of glacial till on the highlands with a cover of marine deposits in limited sections of the lowlands. Shallow deposits of silts and sands from river flooding and recent fills are scattered throughout the lower reaches of the island.

9. MAIN RIVER AND TRIBUTARIES

The Penobscot River is formed by the junction of its East and West Branches at Medway, located about 60 miles north of Old Town, and follows a general southerly course to its mouth on Penobscot Bay. The river has a total drainage area of 8,570 square miles which includes five principal tributaries, the East Branch, West Branch, Mattawamkeag, Piscataquis and Passadumkeag. The East Branch Penobscot River drains the extreme northern portion of the basin while the West Branch drains the northwestern portion. The combined drainage areas of these two tributaries is 3,200 square miles. The Mattawamkeag River drains the northeastern portion of the basin and joins the main river at Mattawamkeag, about 10 miles south of Medway. It drains an area of about 1490 square miles. The other two major tributaries, the Piscataquis (DA 1454 sq. mi) and Passadumkeag Rivers (DA 385 sq. mi) drain the central portion of the basin and discharge into the main river at Howland and Passadumkeag, respectively. The watershed is mostly forested with about one-eighth of the land area being used for farming.

10. STREAM CHARACTERISTICS

Penobscot River flows in a general southerly direction for 74 miles from Medway to tidewater at Bangor, Maine. Along this reach, the river falls 240 feet at a fairly uniform slope. It continues further for 31 miles to its terminous at the head of Penobscot Bay. Much of the Penobscot River Basin consists of low, rolling hills rising above wide, flat valleys. In addition, numerous lakes and swamps throughout the basin help reduce and retard peak flood discharges.

11. MAPS

Topography of the Old Town area is shown on U.S. Geological Survey Map indexed as Orono, Maine and at a scale of 1: 62,500 with a contour interval of 20 feet. The Penobscot River Basin, showing the site of the proposed local protection project, is shown on Plate B-1 (Basin Map) accompanying this report. A detailed plan of the site of proposed improvements at Indian Island is shown on Plate 1 (General Plan).

F. HYDROLOGY AND HYDRAULIC DESIGN

12. CLIMATOLOGY

The Penobscot River Basin has a variable climate with relatively cool summers and usually severe winters. Short periods of heavy precipitation are frequently experienced but the average monthly precipitation is distributed uniformly throughout the year. An analysis of climatology, including temperatures, rainfall and snowfall data is included in Appendix B of this report.

13. RECORD FLOODS

The greatest known flood stage at Old Town occurred during early May 1923 following 3 days of heavy rains upon a snow-covered basin. This storm yielded a maximum recorded precipitation of 5.3 inches at Millinocket, Maine. The most recent flood occurred on 30 April 1973 when over 2.5 inches of rain fell on the basin. The peak discharge for this storm taken at the Milford Dam, located 2000 feet downstream from Indian Island was 75,000 c.f.s. as compared to the record flood discharge of 103,000 c.f.s. A more complete analysis of these storms is included in Appendix B.

14. FLOOD FREQUENCIES

A flood frequency analysis was made, based on a 56 year period of record, for discharges on the Penobscot River at the Milford Dam, located 2000 feet downstream from Indian Island. The statistical analysis of past floods indicated that the record flooding of May 1923 had a frequency of once in 200 years while the April 73 flood stage could be expected to occur once in 25 years.

15. PROJECT DESIGN FLOOD

Although the proposed project will provide protection against a standard project flood, the record flood has been selected as the Project

Design Flood, because of a difference in snowmelt and non-snowmelt conditions. It was concluded that, although an SPF storm coincident with optimum snowmelt conditions is possible it is very remote. The top of dike elevation of 110.0 feet above m.s.l. would provide 2.7 feet of freeboard above record flood levels and 1.0 feet of freeboard above the SPF level.

G. ECONOMIC DEVELOPMENT AND FLOOD DAMAGE

16. ECONOMIC BASE

Indian Island Reservation, inhabited by approximately 350 members of the Penobscot tribe, has been designated by the Economic Development Administration as being economically distressed. A chronically distressed labor market area is one with a substantial and persistent surplus of unemployed labor. In October 1973, the unemployment rate for the nation was 4.5 percent and in the State of Maine it was 5.8 percent. Indian Island experienced an abnormally high rate of 20 percent unemployment primarily resulting from a decline of major sources of employment in Old Town and Bangor. Local industries in these communities have not been able to take up the slack in surplus labor and new industries have not entered in sufficient mass concentrations to provide a permanent solution.

An analysis and comparative study of current trends in population, labor force, employment, education and median family income shows that poverty is not just a loosely used descriptive noun, but unfortunately, a true way of life for Indian Island. The economy of the Reservation is compared to that of its neighboring communities, Old Town and Bangor, the largest source of employment for the populace. Situated in Penobscot County, and closely adjacent to Hancock County, data for these counties, along with information on the State of Maine, is presented herein to give a more vivid picture of economic inadequacy and poverty at Indian Island.

Population. Population is one way to measure economic growth or decline. While the population of the United States increased by 14% over the decade of the sixties, the population of Maine was relatively stable with an increase of 2%. Not only did Maine grow very slowly in comparison to national statistics, but many towns and counties within the state grew even less or lost population. Penobscot County and the city of Bangor, the main sources of employment for Indian Island, both lost population of 1% and 15% respectively from 1960 to 1970.

Indian Island itself experienced a net out-migration of 250 people, basically between the prime working ages of 25 to 40, while the state had a net in-migration of 23,000 persons. Furthermore, Indian Island has a high population density of 700 persons per square mile when compared to 30 persons per square mile for Maine, 35 for Penobscot County and 205 for Old Town. The share of state population of 3 of the 4 political entities declined or remained stable over the decade as shown in Table 1.

This can be readily attributed to the poor employment opportunities. Eighty-two percent of all the firms within Maine employ 100 or more people; however, in Penobscot County 85 percent of the firms have less than 100 employees. Small firms do not encourage population growth because they offer low wages, limited opportunities for advancement and generally are associated with slow growth industries.

TABLE 1 - TOTAL POPULATION

| | <u>1960</u> | <u>1970</u> | <u>Percent Change</u> | <u>Community Population As Percent of Maine Population</u> | |
|---------------|-------------|-------------|---------------------------|--|-------------|
| | | | | <u>1960</u> | <u>1970</u> |
| Indian Island | 600 | 350 | -42 | -- | -- |
| Old Town | 8,626 | 9,057 | +05 | 0.89 | 0.91 |
| Bangor | 38,912 | 33,168 | -15 | 4.0 | 3.3 |
| Penobscot | 126,346 | 125,393 | -01 | 13.0 | 12.6 |
| Hancock | 32,300 | 34,590 | +07 | 3.3 | 3.5 |
| Maine | 969,265 | 992,048 | +02 | -- | -- |

Civilian Labor Force. In an economically depressed region where most of the firms employ less than 100 people, unemployment figures may not be a true indication of the welfare of the populace. Labor force participation rates and changes in the labor force more often will reflect a truer picture than the actual absolute number of unemployed. Unfortunately for Indian Island, all three measurements show economic deprivation and poverty during the decade of the 1960's.

TABLE 2 - TOTAL CIVILIAN LABOR FORCE

| | <u>Civilian Labor Force</u> | | <u>Percent Change</u> |
|---------------|-----------------------------|-------------|-----------------------|
| | <u>1960</u> | <u>1970</u> | |
| Indian Island | -- | 92 | -- |
| Old Town | 3,245 | 3,760 | +15.9 |
| Bangor | 13,000 | 12,600 | -3.0 |
| Penobscot | 43,000 | 46,200 | +7.4 |
| Hancock | 11,300 | 12,450 | +10.2 |
| Maine | 353,500 | 387,000 | +9.5 |

TABLE 2 - TOTAL CIVILIAN LABOR FORCE (Continued)

| | <u>Labor Force as Percent of Population</u> | | <u>Unemployment as Percent of Labor Force</u> | |
|---------------|---|-------------|---|-------------|
| | <u>1960</u> | <u>1970</u> | <u>1960</u> | <u>1970</u> |
| Indian Island | -- | 26.3 | -- | 20.0 |
| Old Town | 37.6 | 41.5 | 5.4 | 4.5 |
| Bangor | 33.4 | 38.0 | 6.2 | 4.7 |
| Penobscot | 34.0 | 36.9 | 6.0 | 4.0 |
| Hancock | 35.0 | 36.0 | 9.3 | 4.4 |
| Maine | 36.5 | 39.0 | 6.5 | 4.7 |
| United States | 39.6 | 40.4 | 6.7 | 4.9 |

While the unemployment picture for all regions was similar to the state's level in the boom year of 1970, Indian Island Reservation experienced an extraordinarily high rate of 20 percent unemployed and an additional 19 percent under-employed. Thus, only 61 percent of the labor force who desired full-time work were able to obtain a 40-hour work week. Increasing employment opportunities not only attract a growing population but also a higher labor force participation rate as marginal workers - women, youth, and elders - enter the labor force. Also people who once left the labor pool because of limited job placement will re-enter the employment market in periods of an industrial expansion.

The labor indicators do not show a healthy economic situation. Bangor's labor force declined and the gain in both Penobscot and Hancock Counties was smaller than Maine's increase of 9 percent. Furthermore, the labor force participation rate for Indian Island in 1970 was only 26 percent as compared to Maine's 39 percent and the United States' 40 percent. Thus, the unemployment picture in 1970 for the state and communities, with the exception of Indian Island, is comparable to that of the United States. However, further examination of labor force participation and other statistical data demonstrate economic weakness and distress.

Personal Income. Median family income reflects a situation similar to that depicted by changes in the labor force and labor participation rates. A study of the period from 1939 to 1954 conducted by different economists has shown that increases in median family income are not always closely correlated with growth in population. Movement out of an area of low income opportunities can raise the average income for those remaining as well as lead to better opportunities for those who departed. On the other hand, median level of education and median family income are generally positively correlated.

Although no data is available for Indian Island Reservation for 1960, the median family income of \$1714* for 1970 was only 24% of the state level of \$7030 as shown in Table 3. With only a median education grade of 7.0 in 1960 and 8.5 in 1970, which was well below Maine's average of 11.0 and 12.2 respectively, employment opportunities were severely limited to this minority group. The dispersion of 1970 median family income stayed within a narrow range of \$600 for all regions in this study. Furthermore, each community and/or county regressed in their share of state's total median income over the ten-year period. Although Old Town fared well in other statistical comparisons, it, along with Bangor, could not offer viable support and strength to the 350 impoverished people of Indian Island. Both of the above communities' economic well-being advanced at a slower pace than that of the state.

TABLE 3 - MEDIAN FAMILY INCOME (1967 CONSTANT DOLLARS)

| | <u>1960</u> | <u>1970</u> | <u>Percent Change</u> | <u>As Percent of Maine 1960</u> | <u>1970</u> |
|---------------|-------------|-------------|---------------------------|-------------------------------------|-------------|
| Indian Island | - | 1714 | - | - | 24.3 |
| Old Town | 5864 | 6730 | 14.8 | 106.7 | 95.7 |
| Bangor | 6034 | 6867 | 13.8 | 109.8 | 97.7 |
| Penobscot | 5752 | 7113 | 23.7 | 104.7 | 101.2 |
| Hancock | 4708 | 6519 | 38.5 | 85.7 | 92.7 |
| Maine | 5494 | 7030 | 28.0 | | |

Employment. In an effort to further depict the poverty and regressing economic welfare of Indian Island, an examination of the employment situation in surrounding political subdivisions was made. Poor education produces poor employment opportunities resulting in abnormally low income, high unemployment, and net out-migration of the population. Without expanding employment opportunities, labor force participation rates will continue to be below the national average of 40 percent.

No statistical information is available on employment classification for Indian Island. However, a discussion with the Community Action Program Director of the Reservation revealed that most of the current jobs for the limited and needy labor force were provided by the Federal government in the construction industry.

In 1970, the service sector was the largest single source of employment in all political subdivisions examined. With the exception of Bangor, manufacturing was the second largest source of employment. In 1960, however, manufacturing was the number one in both Old Town and the State. This transition is typical of that experienced by other areas in New England during the decade of the sixties. A comparison of percent distribution of employment by industry is indicated in Table 4.

*Expressed in constant 1967 dollars.

TABLE 4 - PERCENT DISTRIBUTION OF EMPLOYMENT BY INDUSTRY

| | <u>Community</u> | | | | <u>County</u> | | | | <u>State</u> | |
|------------------------------------|------------------|-------------|---------------|-------------|------------------|-------------|----------------|-------------|--------------|-------------|
| | <u>OLD TOWN</u> | | <u>BANGOR</u> | | <u>PENOBSCOT</u> | | <u>HANCOCK</u> | | <u>MAINE</u> | |
| | <u>1960</u> | <u>1970</u> | <u>1960</u> | <u>1970</u> | <u>1960</u> | <u>1970</u> | <u>1960</u> | <u>1970</u> | <u>1960</u> | <u>1970</u> |
| Agriculture & Mining | 01 | 00 | 01 | 02 | 04 | 03 | 10 | 08 | 07 | 04 |
| Construction | 06 | 06 | 05 | 03 | 06 | 06 | 11 | 13 | 06 | 06 |
| Manufacturing | | | | | | | | | | |
| Durable | 10 | 04 | 03 | 03 | 08 | 06 | 07 | 06 | 10 | 10 |
| Nondurable | 32 | 28 | 14 | 11 | 23 | 21 | 14 | 14 | 23 | 18 |
| Trans, Comm, Public Utility | 04 | 04 | 09 | 09 | 07 | 07 | 05 | 06 | 06 | 06 |
| Wholesale and Retail Trade | 16 | 15 | 25 | 27 | 19 | 20 | 16 | 18 | 18 | 19 |
| Finance, Insurance, Real Estate | 03 | 04 | 05 | 05 | 03 | 03 | 03 | 03 | 03 | 03 |
| Service & Others | 28 | 40 | 36 | 39 | 31 | 35 | 33 | 33 | 27 | 33 |
| TOTALS | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

In 1972, over 34,000 union members in Maine were employed in manufacturing. Eighty percent of these workers, however, were employed in the State's five leading manufacturing industries -- paper, food, leather goods, lumber, and textiles. The paper industry is dominant in Penobscot County and the food industry in Hancock County. In Bangor, 33 percent of the manufacturing labor force is employed in the paper industry. The problem is that the distribution of manufacturing employment in the two counties is heavily concentrated in the State's exporting industries which are producing products which are expected to have slow growth rates over the current decade. Paper, which accounts for some 30 percent of total product value as Maine's leading industry, will be adversely influenced. The second place food industry and fifth ranked textiles, which sell much of this product outside the State, are technologically efficient, but growth and expansion will be minimal in the nation as a whole. Lumber, wood, and leather industries face similar growth roadblocks, with low productivity in leather and minimal employment opportunities in the lumber industry.

17. CHARACTER OF FLOODED AREA AND LOSSES

The low-lying southern end of Indian Island, consisting of approximately 4.5 acres and the road connecting it to the mainland, are subject to frequent, damaging flooding when high stages occur on the Penobscot River. This often flooded area is the oldest built-up section of the island nearest the mainland and in it are located eighteen houses, a Roman Catholic Church, a general store, laundromat, Indian Agent Office building and cemetery. Two trailers and eight garages are also in the area of direct flooding. The homes are one and two-story wood-frame having no basements with foundations consisting of cedar post sills which suffer repeated water damage and have to be replaced periodically when they deteriorate.

During serious flooding periods, families often have to be relocated until damages can be repaired. In addition, the only access road to other properties on the island is inundated, thereby isolating some 87 families. There is a loss of employment, a disruption of services such as health, fire and police protection, and a serious health hazard which results from inundation and backup of existing sewage systems. Recent flooding has been occurring more frequently and residents are fearful that future flooding will completely destroy their homes. The Bureau of Indian Affairs and the Tribal Council strongly feel that the best interests of the people can be served by provision of permanent flood protection.

In essence, Indian Island is located about 2000 feet upstream and within the pool of the Milford Dam which is owned by the Bangor Hydro-electric Power Company. The most recent flood occurred on 30 April 1973 when the Penobscot River crested at elevation 106.75 feet MSL at the Milford Dam. The maximum pond elevation at the Milford pond for

the 56-year period of record is 107.4 feet MSL which occurred on 1 May 1923 with a discharge estimated at 103,000 cfs past Milford. Due to low elevation at Indian Island, flooding results from above normal river and pool stages. Flooding primarily occurs in the Spring, but has occurred at other times of the year as well.

In 1971, two temporary earth dikes were constructed along each side of the southern end of Indian Island under Operation "Foresight" emergency actions. These dikes are approximately five feet high with a ten-foot wide top and about 540 and 700 feet long on the east and west sides respectively. They performed satisfactorily during the high river flows of the Spring 1971 runoff period. However, the earth fill materials settled in certain areas and the existing drainage outlet gates were damaged so that high river flows on 30 April 1973 inundated the area before the dikes could be sandbagged and drainage pipes blocked.

A detailed flood damage survey of Indian Island was conducted in June 1973 to determine the extent of damages that would be experienced in a recurrence of the record flood stage or even higher stages. This survey consisted of a field examination and personal interviews with local officials as well as property owners affected by the flooding. Based on this survey, it is estimated that a recurrence of the record flood level of May 1923 would cause losses of \$50,000 under current conditions. An estimated 85 percent of these losses are residential, while the remainder are to commercial establishments, namely; a grocery store and laundromat, and two public facilities. The grocery store is a one-story, wood-frame structure without a basement, resting directly on the ground. The laundromat is also a one-story, wood-frame structure without a basement with foundations consisting of cedar posts supporting the sills which suffer repeated water damage. One public facility, the Indian Agency Office, is similar in construction to the laundromat. The other public facility, the Roman Catholic Church, is a large modern wood-frame structure, 35 feet in height, with basement and central heating subject to flood damage. It has been recently painted. Also, there are two mobile homes, factory built and brought to the location, which are used in Federal programs to help the needy. Recurring losses at various stages of flooding were combined with stage-frequency data to derive annual losses of \$9,100.

18. FUTURE DEVELOPMENT

Population decreases and a declining share of the median family income in Bangor and Indian Island can only be reversed with new job opportunities in such nationally growing industries like electrical equipment supplies, chemicals, and non-electric machinery. Expansion in manufacturing and goods-producing industries will give greater stimulus to higher incomes than the growth in the service-producing

industries which took place during the 1960's. This is particularly true for both Old Town and Bangor, the two main employment centers for Indian Island.

Since Indian Island is primarily a residential community, it is highly unlikely that manufacturing, particularly durable goods, will develop on the Reservation. Thus, it is highly disruptive when water flows inundate the only access road to the mainland and prevent the workers from reaching their places of employment. The children go to school in Old Town by bus and often miss several days of classes. Furthermore, fire, health and ambulance services from Old Town are disrupted.

It is also highly improbable that there will be any growth in flood loss potential. The southern flooded area, having been developed before the northern section, is already heavily congested. A new sewer system and water supply system will hopefully be built in the current year. Other major improvements are being planned for the flood free north end. These endeavors are not so much job producer orientated; they are an attempt to improve the quality of life for the residents. For example, HUD plans to build 60 units of low income housing and a large community center.

The installation of permanent dikes could be a big boost to island morale. At the current time, the attitude of the residents of the Reservation is very poor. Why should the appearance of the island, homes, and personal property be maintained when the residents annually expect flood conditions to deteriorate the physical attributes of the island. Therefore the psychological mood of the populace would be immensely improved with the installation of the permanent dike fixtures. Tourism could be further encouraged and recreation opportunities developed.

H. EXISTING CORPS OF ENGINEER FLOOD CONTROL PROJECTS

There are no authorized Corps of Engineers flood control projects within the watershed of the Penobscot River. As already noted during Operation Foresight 1971 the Corps constructed temporary emergency dikes at the southerly end of Indian Island under Public Law 99.

I. IMPROVEMENTS BY FEDERAL AND NON-FEDERAL AGENCIES

No improvements have been made by other Federal agencies on Indian Island in Old Town, Maine. In 1970, the U.S. Department of Agriculture, Soil Conservation Service studied the possibility of constructing a flood control project to protect properties at the southerly end of the Island, but this study was terminated following the construction of the emergency dikes in 1971. Data collected by the SCS Study was furnished to the Corps of Engineers. There are no non-Federal flood control improvements on Indian Island.

J. IMPROVEMENTS DESIRED

Meetings have been held with local interests to determine their attitude towards the proposed plan of flood control. Local interests are desirous of preventing future flood losses along the Penobscot River and support the proposed permanent plan, as outlined herein as a means to reduce future damage potential to the southern end of Indian Island as they are aware that the existing dikes were only meant to function as a temporary emergency measure. A public meeting was held on 23 January 1973 at which time there was no opposition voiced to the proposed plan of improvements. A digest of this meeting is included as Appendix C of this report. The Penobscot Indian Tribe and Maine Dept of Indian Affairs have expressed a willingness to fully cooperate on this proposal for flood protection. Letters of concurrence and comment from local interests are included in Appendix A of this report.

K. FLOOD PROBLEM AND ALTERNATIVES CONSIDERED

19. FLOOD PROBLEM

The flood problem is one of general overbank flooding of the Penobscot River causing flooding to residence and businesses at the southern end of Indian Island. The flood of record occurred in May 1923 and had a peak discharge of 103,000 cfs over Milford Dam. It reached an elevation of 107.3 feet m.s.l. at Indian Island or three to four feet over the existing bank. During the April 1973 flood, moderate flooding was experienced throughout the area due to deterioration of the existing temporary dikes and flap gate structures. Emergency sandbagging and portable pumps were used to alleviate this interior flooding.

20. ALTERNATIVES CONSIDERED

Consideration has been given to other methods of solving the flood problem at Indian Island. One alternative consisted of land-fill construction, whereby approximately 6 acres of land and the existing roadway would be raised an average of 4 to 5 feet. This plan would require modifications of homes in the low area. A second plan would include the construction of two dikes, a permanent pumping station, interior drainage facilities and appurtenances. Both plans were found to have annual costs which exceeded annual benefits and were rejected. Plans for upstream reservoirs or channel diversions were found to be impractical or were prohibitive in costs. The plan, as presented herein, is the most economically feasible and will cause the least environmental impact.

L. PROPOSED IMPROVEMENT

21. GENERAL DESCRIPTION

The proposed plan to prevent flooding at the southern end of Indian Island, provides for the incorporation of two temporary earth dikes into a permanent flood protection project. The existing drainage pipes and gates will be removed and replaced with more reliable facilities. Portable pumps will be provided to discharge interior runoff. A description of the project follows and a general layout of the recommended plan is shown on Plate 1.

22. DIKES

This item of work consists of raising and reconstructing the temporary dikes to provide permanent flood protection. The dikes, located on the east and west sides of the island, will be 560 feet long and 700 feet long respectively. The top elevation will be increased from 107.0 to 110.0 feet m.s.l. and the top width increased from 10 to 12 feet. The dike will be composed of compacted impervious fill. The riverside of the dikes will have a 24-inch layer of stone slope protection placed on 12-inches of gravel bedding stone. A 6-inch layer of seeded topsoil will be placed on the landside slopes. The dike will have a riverside slope of 1 vertical on 2 horizontal and a landside slope of 1 vertical on 4 horizontal. Cross-sectional views of the dikes are shown on Plates 1 and 2.

23. DRAINAGE.

Drainage from approximately 10 acres is intercepted by the two temporary dikes and is presently discharged in six 12-inch diameter

corrugated metal pipes. These existing drains are to be replaced with two 18-inch diameter reinforced concrete pipes, one through each dike. Each drain will be equipped with a flap gate on the riverside and a shear gate on the landside of the dike. This shear gate will be manually operated and will permit positive closure of the drain. Runoff will normally flow by gravity through these gated openings but during flood periods, these gates will be closed and portable pumps will be used to discharge the interior runoff into the river. Two portable, self-priming, centrifugal pumps with a combined capacity of 4 cfs at an operating head of 10 feet will be provided to discharge interior drainage. These pumps will be stored in a nearby building owned by the Penobscot Indian Tribe.

24. RELOCATION OF UTILITIES

The construction of the dikes and appurtenant structures will not require the relocation of any utilities. A manhole located along the east dike alignment, but no longer in service, will be removed. Preliminary plans to construct sewage treatment facilities on Indian Island have been made and coordinated with the consulting engineer. Construction of the facilities is currently scheduled for the summer of 1974. Studies revealed that the proposed plan of local flood protection will not interfere with either the sewer lines, treatment plant or pumping stations. The treatment plant and pumping stations are located outside the limits of the dikes and the sewer lines and manholes behind the dikes will be protected from inundation.

25. FOUNDATIONS, EMBANKMENTS AND MATERIALS

a. Foundation Conditions. Inspection of the site indicates that the foundation soils for the dikes consist of about a foot of topsoil overlying moderately compact, variable, silty fine sand, silty medium to fine sand and gravelly silty sand. Existing dikes constructed of compacted gravelly silty medium to fine sand occupy portions of the proposed dike alignments. There is a bedrock outcrop at the north end of the proposed west dike alignment. Except for the topsoil, the foundation soils are characterized by moderately high shear strength, low permeability and low compressibility under the anticipated loadings.

b. Embankment Design. Typical dike embankment sections are shown on Plates 1 and 2 and were developed so as to provide adequate stability and seepage control. The rock protection layers have been designed to resist anticipated river currents, wave action and ice. Landside slopes will be topsoiled and seeded for protection against erosion from surface runoff.

c. Seepage. It is estimated that, at the anticipated maximum river level, the total seepage through and under the proposed dikes will be about 0.02 cfs.

d. Earth Fill. Earth fill material of low permeability and high shear strength can be obtained from glacial till deposits within a 10-mile haul. It is intended to specify a contractor-furnished material meeting the following gradation requirements:

| <u>Sieve Size</u> (U.S. Standard) | <u>Percent Passing</u> by Dry Weight |
|--------------------------------------|---|
| 6-inch | 100 |
| No. 4 | 70-95 |
| No. 200 | 20-50 |

e. Gravel Bedding. Gravel bedding material is available from commercial sources within a 20-mile haul. The material will be contractor-furnished and meet the following gradation requirements:

| <u>Sieve Size</u> (U.S. Standard) | <u>Percent Passing</u> by dry Weight |
|--------------------------------------|---|
| 6-inch | 100 |
| 3-inch | 85-100 |
| 1-inch | 60-85 |
| No. 4 | 30-60 |
| No. 40 | 10-35 |
| No. 200 | 0-10 |

f. Rock Protection. Rock protection material is available from quarries within a 20-mile haul. The material will be contractor-furnished quarried rock fragments, well graded between the specified maximum and minimum sizes. The maximum size stone shall weigh between 150 and 300 pounds and the minimum size stone shall be that just passing the 2-inch U.S. Standard Sieve. No more than 10 percent, by dry weight of the material shall pass the 2-inch Sieve.

g. Concrete. Approximately 25 cubic yards of concrete will be required for this project. The concrete will be subject to severe climatic conditions with alternate cycles of freezing and thawing during the winter months. For durability, therefore, air-entrained concrete is considered mandatory. Under normal conditions, the concrete will

function with only exposure to the atmosphere and therefore only regular quality concrete with a maximum water-cement ratio of 5.0 and satisfying the structural requirements will be necessary. Considering the small quantities of concrete involved, the specifications will provide for the use of local aggregate, a manual concrete plant and ready-mixed concrete. There are several plants within a 20-mile haul which will satisfy these requirements.

26. HYDRAULIC DESIGN

The dikes at Indian Island, with a top elevation of 110.0 feet m.s.l., will provide 2.7 feet of freeboard above the 1923 record flood elevation of 107.3 feet m.s.l. This May 1923 flood has a frequency of occurrence of approximately once in 200 years. Ice jams are also a present flood threat on the Penobscot River, but at Indian Island these jams generally occur during moderate increases in flow and become dislodged prior to the occurrence of peak flow. Consequently, the resulting peak river stage is unaffected by ice and for this reason no special freeboard allowance was provided in design over and above the 2.7 feet above record flood stage. Appendix B presents hydrologic and hydraulic criteria applicable to the design of the dikes, as well as climatology, flood frequency, design height of protection and interior drainage.

M. MULTIPLE PURPOSE FEATURES

The plan for flood protection at Indian Island, Old Town, Maine offers no multiple purpose features and is designed solely for flood protection.

N. REAL ESTATE REQUIREMENTS

Approximately two acres of permanent easements will be required for the two proposed dikes. The project will not require the taking or removal of any buildings nor will residents be displaced. Temporary construction easements are to be provided along certain drive-ways that extend to the work area.

O. ESTIMATES OF FIRST COSTS AND ANNUAL CHARGES

27. GENERAL

The estimates of Federal and non-Federal first costs and annual charges given on Table 1, have been prepared on the basis that local

interests would furnish all lands, easements, and rights-of-way necessary for project construction; and maintain the project after completion. Estimates are based on 1973 price levels and include minor items of work which are not separately detailed in the cost estimate.

28. BASIS OF COST ESTIMATES

Cost estimates have been made upon the basis of a design which would provide an economical and safe structure. Estimates of quantities are based on neat outlines of the proposed designs and foundation requirements. Costs were computed as outlined in the Corps of Engineers Engineering Manual 1120-2-104.

29. CONTINGENCIES, ENGINEERING, SUPERVISION AND ADMINISTRATION

Estimates of construction costs have been increased 15 percent to cover contingencies. The cost of engineering and design and supervision and administration has been taken as 20.3 percent and 12.7 percent of the construction cost respectively.

30. BASIS OF ANNUAL CHARGES

Annual charges are based on a 50-year project life with a 5-5/8 percent interest rate. Interest during construction has been omitted from the investment cost since the construction period would be less than two years. Local interests would bear annual maintenance costs which were based on previous experience with similar projects.

P. ESTIMATES OF BENEFITS

The primary benefit that would accrue to the dike protection plan for Indian Island would be the reduction of future flood damages. The plan would also provide intangible area benefits such as improved public health, improved police and fire protection and increased morale to the area's inhabitants. Future average annual flood damages prevented represent the difference in average annual flood damages that would be expected without the project and residual average annual damages that would exist with the project. These benefits amount to \$8,900. Direct beneficiaries of this flood control plan of improvement are mainly the owners of the several residences and two commercial establishments in the flood prone area. Indirect beneficiaries are the Islands remaining individual property owners whose inconveniences and disruptions to their normal pattern and quality of life would be prevented.

Q. COMPARISON OF BENEFITS AND COSTS

The tangible economic justification of the plan of improvement can be ascertained by comparing equivalent average annual costs (including interest, amortization and maintenance) with an estimate of the equivalent average annual benefits which would be realized for the plan over a 50 year period of analysis. This economic life is believed to be reasonable since the project would provide a very high degree of protection. Values of costs and benefits that would accrue to the plan at different times were made comparable by conversion to an equivalent time basis using the current Federal interest rate of 5-5/8 percent. With average annual benefits of \$8,900 and average annual costs estimated at \$6,716 as shown in Table 5; the resulting ratio of benefits to cost is 1.32 to 1.0.

R. PROJECT FORMULATION AND ECONOMIC JUSTIFICATION

Past floods have caused substantial damage to the lands and existing structures located at the southern end of Indian Island. Of the two alternatives considered practical, a plan consisting of the construction of two dikes and appurtenant drainage facilities was found to be the most favorable. The major item considered in the formulation of various alternative plans of protection was the degree of protection which could be economically justified and the desires of local interest which favored the incorporation of the existing dikes into a permanent flood control plan. Other plans to protect the area were investigated, and found to lack economic justification. The proposed plan affords construction feasibility and compatibility with existing improvements in the area. Total project costs of the recommended plan are estimated at \$105,000, yielding a benefit-to-cost ratio of 1.32 to 1.0.

S. ENVIRONMENTAL STUDIES

A draft environmental assessment has been prepared in accordance with ER 1105-2-507 and has been approved by the Division Engineer. He concludes that the environmental impact is minimal and not controversial and therefore an environmental impact statement will not be prepared.

T. SCHEDULES FOR DESIGN AND CONSTRUCTION

The preparation of contract plans and specifications for the project will cost \$16,000 and can be completed in four months. Construction of the project can be accomplished under a single contract and within a nine-month period.

TABLE 5

ESTIMATES OF FIRST COSTS AND ANNUAL CHARGES
LOCAL PROTECTION, INDIAN ISLAND, OLD TOWN, MAINE

FIRST COST
(1973 Price Level)

FEDERAL COST

| <u>Item</u> | <u>Quantity</u> | <u>Unit</u> | <u>Unit Price</u> | <u>Amount</u> |
|--|-----------------|-------------|-------------------|---------------|
| Mobilization and Demobilization | 1 | Job | L.S. | \$ 1,300 |
| Preparation of Site | 2 | Acres | 570 | 1,140 |
| Earth Excavation | 3100 | c.y. | 2.00 | 6,200 |
| Compacted Imprevious Fill | 4500 | c.y. | 3.75 | 16,875 |
| Rock Slope Protection | 1600 | c.y. | 15.75 | 25,200 |
| Gravel Bedding | 1400 | c.y. | 3.10 | 4,340 |
| Topsoil | 500 | c.y. | 6.25 | 3,125 |
| Seeding | 3000 | s.y. | .50 | 1,500 |
| 18" Reinforced Concrete Pipe | 100 | l.f. | 12.00 | 1,200 |
| Portable Pump (with tubing) | 2 | each | 2000 | 4,000 |
| Flap Gates | 2 | each | 200 | 400 |
| Shear Gates | 2 | each | 650 | 1,300 |
| Concrete | 30 | c.y. | 70.00 | <u>2,100</u> |
| Sub-Total | | | | \$ 68,680 |
| Contingency | | | | <u>10,320</u> |
| TOTAL CONSTRUCTION COST | | | | \$ 79,000 |
| Engineering and Design | | | | 16,000* |
| Supervision and Administration | | | | <u>10,000</u> |
| TOTAL ESTIMATE FEDERAL FIRST COST | | | | \$105,000 |
| <u>NON-FEDERAL COST</u> | | | | |
| Lands and Damages | | | | 0 |
| TOTAL ESTIMATED NON-FEDERAL FIRST COST | | | | 0 |
| TOTAL ESTIMATED PROJECT FIRST COST | | | | \$105,000 |

*Does not include preauthorization cost of \$13,000

TABLE 5 (Continued)

ANNUAL CHARGES

Federal

| | |
|--|---------|
| Interest and Amertization (.06015 x 105,000) | \$6,316 |
|--|---------|

Non-Federal

| | |
|---------------------------|------------|
| Interest and Amertization | 0 |
| Maintenance | <u>400</u> |

\$ 400

| | |
|-------------------|---------|
| TOTAL ANNUAL COST | \$6,716 |
|-------------------|---------|

U. OPERATION AND MAINTENANCE

Project maintenance would be the responsibility of local interests with periodic inspections made by the Corps to assure that adequate maintenance is performed in accordance with regulations prescribed by the Secretary of the Army. Maintenance cost of \$400 annually are anticipated. An operation and maintenance manual would be provided to the Department of Indian Affairs of the State of Maine and the Penobscot Indian Tribe upon completion of the project.

V. LOCAL COOPERATION

Officials of the Department of Indian Affairs and the Penobscot Indian Tribe have indicated their concurrence in the plan of improvements as well as a willingness to comply in accordance with Public Law 87-874 with the following items of local cooperation:

- (1) Provide without cost to the United States all lands, easements, right-of-way and utility relocations and alterations necessary for project construction.
- (2) Hold and save the United States free from damages due to the construction works and adjust all claims concerning water rights.
- (3) Maintain and operate the project after completion in accordance with regulations prescribed by the Secretary of the Army.
- (4) Assume full responsibility for all project costs in excess of the Federal cost limitation of \$1 million.
- (5) Prevent future encroachment which might interfere with proper functioning of the project for flood control.

Letters from local officials, constituting preliminary assurances, are included in Appendix A.

W. COORDINATION WITH OTHER AGENCIES

Plans for local protective works at Indian Island have been reviewed by officials of the Penobscot Indian Tribe and the State of Maine. Their endorsement of the proposed plan is indicated by letters in Appendix A. Copies of comments from other Federal agencies are also included as exhibits in Appendix A. The project will have no effect upon hydroelectric power generation, recreation, pollution abatement, fish migration, or other collateral water resource uses of the Penobscot River.

X. STATEMENT OF FINDINGS

I have reviewed and evaluated, in light of the overall public interests, the documents concerning the proposed action, as well as the stated views of other interested agencies and the concerned public, relative to the various practicable alternatives in accomplishing local flood protection along the Penobscot River at Indian Island, Old Town, Maine. The possible consequences of these alternatives have been studied for environmental, social well-being and economic effects, including regional and national development and engineering feasibility. In evaluation of the selected plan and other viable alternatives the following points were considered pertinent:

a. Environmental Considerations.

From an environmental standpoint, the selected plan will afford more enhancement than adverse effects. The recommended project will have beneficial effects on flood control, aesthetics and the environmental setting. Only minimal vestiges of the existing environment will be changed by the proposed plan. This includes clearing and grubbing of a few willow trees. Overall, the project would minimize the danger of flooding in the lowlying area of Indian Island and result in upgrading of the residential environment and aesthetics. The project offers no opportunities to benefit fish and wildlife resources, nor will it have any adverse effects upon these resources. Silt traps utilized during construction will keep short-duration siltation to a minimum. Long-term siltation will be reduced due to placement of stone in areas that were previously susceptible to erosion. The aesthetics of the existing area will be enhanced by the elimination of unsightly and undesirable physical conditions within the limits of the proposed earth dikes. This includes filling, topsoiling and seeding of areas that currently have standing water. Therefore, mosquito breeding area will be eliminated from the site of the proposed improvement. No adverse environmental effects are known or anticipated if the project is implemented.

b. Social Well-being Considerations.

I find that the overriding social well-being consideration for the people of the Penobscot Indian Tribe is the elimination of the flood hazard to their homes and incidental health problems that occur during and subsequent to flood periods. The recommended project will provide a high degree of protection resulting in greater security for the people in the flood zone and ensuring access for fire and police vehicles to the island during flood periods. The project will not require any permanent relocations or temporary displacement of inhabitants and will not disturb their existing way of life.

c. Engineering Considerations.

From an engineering standpoint the selected project will provide the highest degree of protection at the least cost. Considerations were given to increasing and/or decreasing height of protection to determine the plan which maximized flood control benefits. Other project alternatives, including non-structural measures, were considered. These included utilization of upstream reservoirs or filling the entire 10 acres of lowlying flood prone lands. Alternative plans did not meet the criteria and requirements for various economic, social and environmental reasons. I have selected the plan that provides protection against a recurrence of record flood levels and also has the least social and environmental impact on the project area.

d. Economic Considerations.

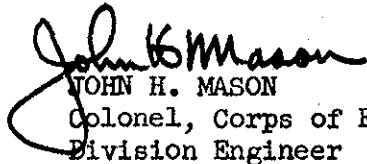
From an economic standpoint I have selected the economically optimum plan by providing a high degree of flood protection which will be conducive to the preservation of the social well-being of the community. The recommended project will have a net effect of increasing land values and will preserve and stimulate growth in the protected area.

e. Other Public Interest Considerations.

I find that the desires of the Commissioner of Indian Affairs for the State of Maine and the people of the Penobscot Indian Tribe are feasible and economically justified based on a combination of tangible and intangible benefits. The flood control improvement will enhance the social well-being and economic and environment aspects of the island area. I concur with the requests and desires of local interests and State officials indicating strong support for the project and early implementation of the construction works.

I find that the action proposed, as developed in the Conclusions and Recommendations, is based on thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objectives; that wherever adverse effects are found to be involved they cannot be avoided by following reasonable alternative courses of action which would achieve the Congressionally specified purposes; that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations of national policy; that the recommended action is consonant

with national policy, statutes, and administrative directives; and that on balance the total public interest should best be served by the implementation of the recommendation.


JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

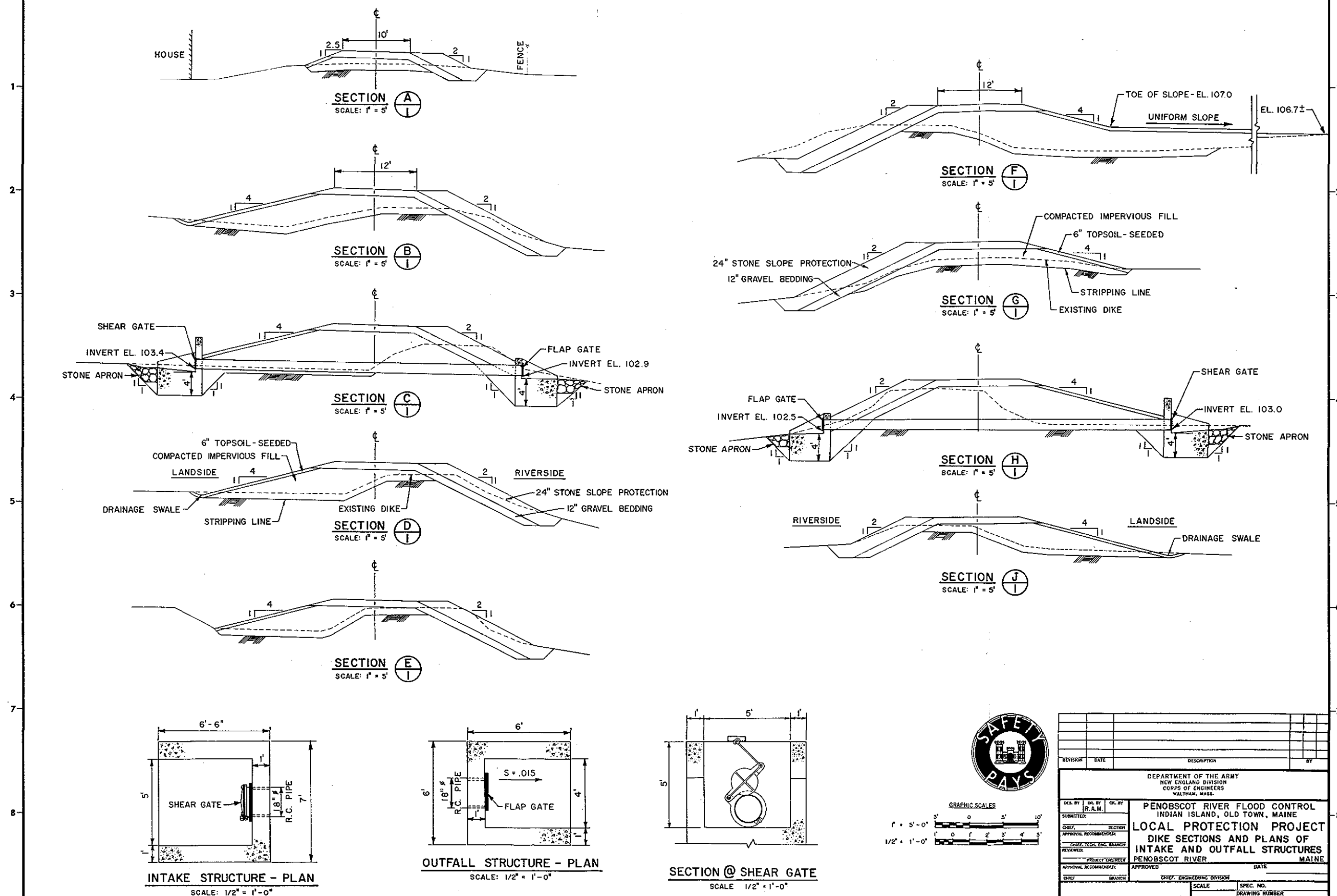
Y. CONCLUSIONS

Studies of alternative means of providing flood control at the southern end of Indian Island lead to the following conclusions:

- a. Indian Island faces the threat of significant damages in future floods. This further burdens an area which is already designated by Department of Commerce as a depressed area.
- b. Local interests desire flood protection and are prepared to meet the requirements of local cooperation.
- c. Flood protection can be provided most suitably by the proposed plan at a total estimated Federal first cost of \$105,000.
- d. The project is economically justified having a ratio of annual benefits to annual costs of 1.32 to 1.0.
- e. The threat of recurring damaging floods makes it desirable to construct the project as soon as possible.

Z. RECOMMENDATIONS

It is recommended that the project, as submitted in this report be authorized by the Chief of Engineers under the provisions of the Flood Control Act of 1948, as amended, and that funds be allotted in the amount of \$16,000 for preparation of plans and specifications and \$89,000 for the construction contract.



APPENDIX A

LETTERS OF CONCURRENCE AND COMMENT

APPENDIX A

LETTERS OF CONCURRENCE AND COMMENT

| <u>Exhibit No.</u> | <u>Letter from</u> | <u>Letter dated</u> |
|--------------------|---|---------------------|
| 1 | Governor, State of Maine | 15 Jan 73 |
| 2 | Commissioner, Department of Indian Affairs, State of Maine | 12 Mar 71 |
| | " | 11 Jun 71 |
| | " | 13 Jan 72 |
| | " | 28 Dec 73 |
| 3 | Governor, Penobscot Indian Tribe | 11 Oct 73 |
| | " | 28 Dec 73 |
| 4 | U.S. Department of the Interior, Fish & Wildlife Service | 23 Mar 73 |
| 5 | U.S. Environmental Protection Agency | 27 Sep 73 |
| 6 | U.S. Department of Agriculture Soil Conservation Service | 3 Oct 73 |
| 7 | Maine Department of Agriculture Soil & Water Conservation Commission | 20 Sep 73 |



STATE OF MAINE
OFFICE OF THE GOVERNOR
AUGUSTA, MAINE
04880

KENNETH M. CURTIS
GOVERNOR

January 15, 1973


John H. Mason
Colonel, Corps of Engineers
Division Engineer
Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Mason:

This is to acknowledge receipt of your notice of public hearings on the construction of two permanent earth dikes at Indian Island, Old Town, Maine.

I am pleased to hear the Corps of Engineers has determined that this construction is economically justified, and I look forward to seeing this project underway.

Sincerely yours,


Kenneth M. Curtis
Governor of Maine

KMC:njm

cc: John Stevens, Commissioner
Department of Indian Affairs

Exhibit No. 1



STATE OF MAINE
DEPARTMENT OF INDIAN AFFAIRS
AUGUSTA, MAINE 04330
TEL. (207) 289-2831

JAMES H. MURPHY
COMMISSIONER

March 12, 1971

Col. Frank P. Bane
Division Engineer
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Col. Bane:

This letter is to seek assistance of your agency in protecting the southerly end of Indian Island of the Penobscot Indian Reservation located in Penobscot County, Old Town area, Maine, from the periodic flooding of the Penobscot River. This assistance is requested under the provisions of Section 205 of the 1948 Flood Control Act, as amended.

There are approximately 30 houses on Indian Island that are periodically subjected to first flood damages from floods. This primarily occurs in the spring, but has occurred at other times of high water during the year.

It is believed that a flood control dike on approximately 2100 feet of land and a pumping station would solve this flooding problem. Our preliminary cost estimate is \$45,000.


This Department may obtain the necessary land rights and may operate and maintain any works of improvement.

Your assistance in this matter will be greatly appreciated.

If detailed background material is desired, please call on us .

Thank you for your consideration.

Cordially yours,


James H. Murphy
Commissioner

JHM:gb



cc: Soil & Water Conservation Commission

MAINE SESQUI-CENTENNIAL 1820-1970

Exhibit No. 2



STATE OF MAINE
DEPARTMENT OF INDIAN AFFAIRS
AUGUSTA, MAINE 04330
TEL. (207) 289-2831

JAMES H. MURPHY
COMMISSIONER

June 11, 1971

Col. Frank P. Bane
Division Engineer
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

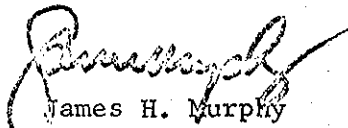
Dear Col. Bane:

The temporary flood control dike has since been completed and I wish to compliment Mr. Richard Marble of your office for the fine and excellent cooperation regarding this project, "Penobscot Indian Flood Control".

It would also be greatly appreciated if the proposed engineering concerning "205" monies for a permanent project could be expedited in order that it could possibly be completed before snowfall in November of 1971.

Again, thank you and your staff for the fine work regarding the temporary dike.

Cordially yours,


James H. Murphy
Commissioner

JHM:gb



STATE OF MAINE
DEPARTMENT OF INDIAN AFFAIRS

AUGUSTA, MAINE 04330

TEL. (207) 289-2831

JOHN W. STEVENS
COMMISSIONER

S. GLENN STARBIRD, JR.
DEPUTY COMMISSIONER

January 13, 1972


Mr. Frank Benoit
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir:

As requested over the telephone, this letter is to verify that the Department of Indian Affairs has no authority to construct a permanent water dike.

I hope this is sufficient for you to go ahead with the project.

Sincerely,


John Stevens
Commissioner

JS:gb



STATE OF MAINE
DEPARTMENT OF INDIAN AFFAIRS
AUGUSTA, MAINE 04330

TEL. (207) 289-2831

JOHN W. STEVENS
COMMISSIONER

S. GLENN STARBIRD, JR.
DEPUTY COMMISSIONER

December 28, 1973

Col. John H. Mason
Division Engineer
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

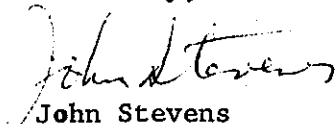
Re: Flood Control Project
Indian Island, Old Town

Dear Sir:

It is the intent of the Department of Indian Affairs to maintain the permanent dike when the construction is completed. We would appreciate any information concerning the cost of maintenance on the dike. It is essential for us to include the cost in our budget.

I hope this letter is sufficient. If not, please get in contact with us as soon as possible.

Sincerely,


John Stevens
Commissioner

JS:gb
cc: Governor Matthew Sappier, Indian Island



Indian Island,
Old Town, Maine
October 11, 1973

William Swaine
Army Corp of Engineers
Waltham, Massachusetts 02540

Dear Sir:

I have received the new plans for the final construction of our dikes. This is a program that I am most anxious to see completed.

In the attached letter, I noticed there is concern to the liabilities of the United States Government to the individuals who have title to the land.

Because of the attractiveness of the completed dikes compared to the emergency measure, and guaranteeing the individual land owners that their property would not be left in a lesser condition, I see no reason why the tribe couldn't have easements ready so that construction could take place in the next season.

Respectfully,

Matthew Sappier
Governor Matthew Sappier
Penobscot Tribe

OFFICE OF THE CHIEF AND COUNCIL
INDIAN ISLAND



December 28, 1973

Col. John H. Mason
Division Engineer
Army Corps of Engineers
424 Travelo Road
Waltham, Mass. 02154

Dear Col. Mason;

The letter of intent, I previously sent, covered only a narrow portion of our flood control project.

Hopefully, by saying that we intend to include in the easements, or by separate form, a section that will insure against construction of buildings or planting of trees etc., will be assurance enough to let the project begin.

I have also contacted Commissioner John Stevens of the Department of Indian Affairs and he assured me that the Department would maintain and operate the project after completion.

Sincerely,

Matthew Sappier
Matthew Sappier
Penobscot Tribal Governor

MS/ek

Exhibit No. 3



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
John W. McCormack Post Office and Courthouse
BOSTON, MASSACHUSETTS 02109

MAR 23 1973

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir:

This is our Conservation and Development Report on the proposed local flood protection project, Penobscot River, Old Town, Penobscot County, Maine. The project is being planned under authority of Section 205 of the Flood Control Act of 1948. This report was prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and in cooperation with the Maine Department of Inland Fisheries and Game, whose letter of comment is attached.

We understand the project is located in the Penobscot River on Indian Island, and will consist of modifying two existing dikes by increasing the top width to ten feet and the land side slopes to five feet horizontal and one foot vertical. The water sides would have stone slope riprap to 18 inches below the low water mark and the land sides would be seeded to provide erosion control. The two existing 12-inch culverts in the dike on the east side of the island would be lengthened and sluice gates with flap valves installed. Portable pumps would be used during critical periods. Trash racks must be provided over entrance to culverts and trash deflectors on discharge end.

Two alternate plans include: (1) construction as formulated above, except that a permanent pumping station would be substituted for the portable pump, and (2) landfill construction whereby 4.5 acres of land and the existing highway would be raised an average of four to five feet. This plan would require modifications to the foundations of eight homes.


Due to low potential for wildlife resources on the project area, these resources would suffer minimal material damage as a result of project construction. Major damage would result by removal of stream side trees.

Siltation from the construction site could have an adverse effect upon fishery resources in the Penobscot River, but these adversities are expected to be minimal and of short duration. We request that silt-traps

or other control methods be used to reduce turbidity during project construction.

Neither the plan nor the alternatives appear to generate any major, long-term problems for fish and wildlife resources; neither does the project offer any feasible opportunities for the enhancement of these resources.

Sincerely yours,

A handwritten signature in dark ink, reading "Willard M. Spaulding". The signature is written in a cursive style with a large, prominent "W" and a long, sweeping "g" at the end.

ACTING Regional Director

Attachment



DEPARTMENT OF

Inland Fisheries and Game

MAYNARD F. MARSH, COMMISSIONER

J. WILLIAM PEPPARD, DEPUTY COMMISSIONER

AUGUSTA, MAINE 04330

R.B. Studies

Olds

Crestin

Zarbock

Wright

Miller, S.

Carney

Dolahaer

Miller, E.

Kazanowski

File

Copy to

March 15, 1973

Mr. Richard Griffith
Regional Director
Bur. of Sport Fisheries and Wildlife
U.S. Post Office and Court House
Boston, Mass. 02109

Dear Mr. Griffith:

Re: Your letter of March 6 pertaining to a review draft of your report on proposed local flood protection project, Penobscot River, Old Town, Maine.

I have enclosed some comments on the project which I received from Al Meister today. It appears that the proposed dikes and culverts, etc. are in the same general vicinity of a proposed sewer line which may be installed some time in the foreseeable future. Al believes that this should be a consideration and that both projects be done at the same time to prevent engineering problems, etc.

Very truly yours,

Maynard F. Marsh
Commissioner

MFM/lab
enclosure

RECEIVED

MAR 19 1973

R. B. S.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I

J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

September 27, 1973

Mr. John Wm. Leslie
Chief, Engineering Division
New England Division, Corps of Engineers
U. S. Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

We have reviewed Public Notice NEDED-R, dated 12 September 1973 regarding the permit application by the Corps of Engineers to make a modification of two temporary earth dikes to permanent dikes in the Penobscot River.

We have no comments on this public notice.

Sincerely yours,

Edward J. Conley
Chief, Permits Branch

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

USDA Office Building, University of Maine, Orono, Maine 04473

October 3, 1973

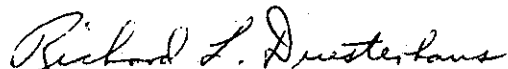
Mr. John Wm. Leslie, Chief
Engineering Division
New England Division, Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

We have reviewed the plans submitted with your letter of September 12, 1973, of providing local flood protection along the Penobscot River at Indian Island in Old Town, Maine.

We thank you for the opportunity of reviewing these plans and have no comment.

Sincerely,



Richard L. Duesterhaus
State Conservationist

Maine Department of Agriculture



Maynard C. Dolloff, Commissioner

September 20, 1973

REPLY TO:

MAINE SOIL AND WATER CONSERVATION COMMISSION
Charles L. Boothby, Executive Director
State Office Building, Augusta, Maine 04330
Telephone 207/289-2666

Mr. John Wm. Leslie
Chief, Engineering Division
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

I have reviewed the preliminary plans for the local flood protection project at Indian Island in Old Town, Maine. The plans seem adequate.

Have arrangements been made with the local sponsor for the timely operation and maintenance of this project once constructed. This would appear to be a very important part in the effectiveness of the total project.

Am looking forward to seeing the final report.

Sincerely,

A handwritten signature in cursive script that reads "Charles L. Boothby".

Charles L. Boothby
Executive Director

CLB/sp

Exhibit No. 7

DIVISIONS

Administration / Animal Industry / Inspections / Markets / Plant Industry / Promotions
Harness Racing Commission / Milk Commission / Seed Potato Board / Dairy Council
Milk Tax Committee / Soil and Water Conservation Commission

APPENDIX B

HYDROLOGY & HYDRAULIC DESIGN

APPENDIX B
HYDROLOGY AND HYDRAULICS
PENOBSCOT RIVER FLOOD CONTROL
INDIAN ISLAND
OLD TOWN, MAINE
LOCAL PROTECTION PROJECT

Table of Contents

| <u>Paragraph</u> | <u>Subject</u> | <u>Page</u> |
|------------------|---------------------------------|-------------|
| 1 | PURPOSE | B-1 |
| 2 | FLOOD PROBLEM | B-1 |
| 3 | BASIN DESCRIPTION | B-1 |
| 4 | CLIMATOLOGY | |
| | a. General | B-2 |
| | b. Temperature | B-2 |
| | c. Precipitation | B-2 |
| | d. Snowfall | B-2 |
| 5 | STREAMFLOW - RUNOFF | B-2 |
| 6 | HISTORIC FLOODS | B-2 |
| 7 | FLOOD FREQUENCY | B-8 |
| 8 | STAGE-DISCHARGE RELATION | B-8 |
| 9 | UNIT HYDROGRAPH ANALYSIS | B-8 |
| 10 | STANDARD PROJECT STORM RAINFALL | B-9 |
| 11 | STANDARD PROJECT FLOOD | B-9 |
| 12 | PREVIOUS TEMPORARY IMPROVEMENTS | B-10 |

| <u>Paragraph</u> | <u>Subject</u> | <u>Page</u> |
|------------------|------------------------------|-------------|
| 13 | PRESENT PLAN OF IMPROVEMENTS | B-11 |
| 14 | DESIGN HEIGHT OF PROTECTION | B-11 |
| 15 | INTERIOR DRAINAGE | |
| | a. General | B-12 |
| | b. Rainfall | B-12 |
| | c. Runoff | B-12 |
| | d. Ponding | B-13 |
| | e. Pumping capacity | B-13 |
| | f. Coincident river stages | B-13 |
| | g. Gravity drains | B-13 |

LIST OF PLATES

| <u>Plate</u> | <u>Title</u> |
|--------------|-------------------------------------|
| B-1 | Basin Map |
| B-2 | 1923 Isohyetal Storm Map |
| B-3 | Discharge-Stage-Frequency Curve |
| B-4 | Stage-Discharge Curve - Milford Dam |
| B-5 | Interior Drainage Hydrology |

LIST OF TABLES

| <u>Table</u> | <u>Title</u> | <u>Page</u> |
|--------------|--|-------------|
| B-1 | Temperature | B-3 |
| B-2 | Precipitation | B-4 |
| B-3 | Snowfall | B-5 |
| B-4 | Streamflow Records | B-6 |
| B-5 | Peak Annual Discharges | B-7 |
| B-6 | 12-Hour Unit Hydrograph - Pertinent Data | B-9 |
| B-7 | Interior Drainage Discharges | B-12 |

APPENDIX B

PENOBSCOT RIVER FLOOD CONTROL INDIAN ISLAND OLD TOWN, MAINE LOCAL PROTECTION PROJECT HYDROLOGY AND HYDRAULICS

1. PURPOSE

This appendix describes the hydrologic criteria and analysis pertinent to the design of flood control improvements for the southern tip of Indian Island located in the Penobscot River at Old Town, Maine. Included are sections on climatology, analysis of floods, previous, temporary and present plan of improvements, and interior drainage.

2. FLOOD PROBLEM

As shown on the basin map, plate B-1 Old Town, Maine, is actually an island in the Penobscot River and Indian Island is a secondary island located in the river channel passing to the left of the main island. Indian Island is also located in the backwater of the Milford Dam of the Bangor Hydroelectric Company. The flood problem on Indian Island requiring the subject project, is located on the south-central tip of the island where, due to low elevations, property is frequently inundated by above normal river and pool stages.

3. BASIN DESCRIPTION

The Penobscot River basin, shown on plate B-2 is located wholly within the state of Maine, between the watersheds of the St. John River to the north, the St. Croix River to the east and the Kennebec River to the west. The river flows south passing through the city of Bangor discharging to the Atlantic Ocean at Penobscot Bay. The northwestern limit of the watershed forms a part of the international boundary between the United States and Canada. The basin has a maximum length in a north-south direction of about 125 miles, maximum width of about 115 miles, and a total area of 8,570 square miles. It is the largest river basin lying wholly in the state of Maine.

4. CLIMATOLOGY

a. General. The Penobscot River watershed has a variable climate characterized by frequent but generally short periods of heavy precipitation. The summers are relatively cool and the winters, especially at inland points, are usually severe. The basin lies in the path of the "prevailing westerlies" and the cyclonic disturbances that cross the country from the west or southwest towards the east or northeast. The area is also exposed to occasional coastal storms, some of tropical origin, that travel up the Atlantic seaboard. These latter storms, locally known as "nor'easters", are heavily laden with moisture from the ocean.

b. Temperature. Average monthly temperatures in the Penobscot River basin vary considerably through the year with a mean annual temperature of about 43°F. Summer temperatures average between 65°F. and 70°F. in July and August while winter temperatures average between 15° and 20° in January and February. The mean, maximum and minimum monthly temperatures for 84 years of record at Orono, located about 3 miles south of Indian Island, are shown in table B-1.

c. Precipitation. The average annual precipitation at Orono is about 40 inches, which is distributed uniformly throughout the year. The maximum and minimum annual precipitation at Orono for 98 years of record are 59 inches and 26 inches, respectively. Table B-2 summarizes the precipitation records for this station.

d. Snowfall. The average yearly snowfall at Old Town, elevation 120 feet msl, for 23 years of record is 88 inches. Table B-3 summarizes the monthly snowfall at this station.

5. STREAMFLOW - RUNOFF

The average annual runoff in the Penobscot River basin is approximately 24.5 inches or about 60 percent of the average annual precipitation. A summary of streamflow records at selected stations published by the U.S. Geological Survey is presented in table B-4.

6. HISTORIC FLOODS

The flood of 1 May 1923 was the greatest known flood on the Penobscot River. Property losses during this event consisted largely of damages to dams and mills. The flood was produced by a 3-day rain on

TABLE B-1

MONTHLY TEMPERATURE
(Degrees Fahrenheit)Orono, Maine
84 Years of Record
Elevation 120 Feet msl

| <u>Month</u> | <u>Mean</u> | <u>Maximum</u> | <u>Minimum</u> |
|--------------|-------------|----------------|----------------|
| January | 17.7 | 65 | -32 |
| February | 19.5 | 64 | -31 |
| March | 29.2 | 83 | -25 |
| April | 41.7 | 89 | 3 |
| May | 53.1 | 98 | 20 |
| June | 62.2 | 98 | 29 |
| July | 67.6 | 100 | 34 |
| August | 66.2 | 104 | 32 |
| September | 58.2 | 97 | 23 |
| October | 47.4 | 90 | 13 |
| November | 35.6 | 78 | - 8 |
| December | 22.4 | 66 | -36 |
| Annual | 43.4 | 104 | -36 |

TABLE B-2
MONTHLY PRECIPITATION
(Inches)

Orono, Maine
98 Years of Record
Elevation 120 Feet ms1

| <u>Month</u> | <u>Mean</u> | <u>Maximum</u> | <u>Minimum</u> |
|--------------|-------------|----------------|----------------|
| January | 3.55 | 8.54 | .40 |
| February | 3.23 | 8.39 | .83 |
| March | 3.29 | 8.20 | .20 |
| April | 2.85 | 5.29 | .60 |
| May | 3.09 | 10.52 | .40 |
| June | 3.12 | 7.49 | .62 |
| July | 3.16 | 7.63 | .27 |
| August | 3.10 | 7.36 | .01 |
| September | 3.65 | 8.07 | .78 |
| October | 3.73 | 9.57 | .58 |
| November | 3.73 | 8.67 | .36 |
| December | 3.41 | 7.94 | 1.01 |
| Annual | 39.9 | 58.74 | 25.99 |

TABLE B-3

MONTHLY SNOWFALL
(Depth in Inches)

Old Town FAA Airport
23 Years of Record
Elevation 115 Feet msl

| <u>Month</u> | <u>Snowfall</u> |
|--------------|-----------------|
| January | 18.9 |
| February | 23.1 |
| March | 14.8 |
| April | 1.9 |
| May | T |
| June | - |
| July | - |
| August | - |
| September | - |
| October | .7 |
| November | 4.2 |
| December | 16.3 |
| Annual | 79.9 |

TABLE B-4

STREAMFLOW RECORDS
PENOBSCOT RIVER BASIN

| <u>Location</u> | <u>Drainage Area (sq. mi.)</u> | <u>Period of Record</u> | <u>Average Annual Runoff</u> (in/yr) (cfs) | | <u>Maximum Discharge</u> (cfs) |
|--|--|-----------------------------|---|--------|---------------------------------------|
| East Branch Penobscot R. at Grindstone, Me. | 1,090 | 1902-1972 | 23.72 | 1,904 | 37,000 30 Apr 1923 |
| Piscataquis R. at Medford, Me. | 1,161 | 1924-1972 | 26.75 | 2,287 | 60,100 4 Nov 1966 |
| Penobscot R. nr. Mattawamkeag, Me. | 3,356 | 1940-1972 | 22.59 | 5,582 | 43,300 29 May 1961 |
| Penobscot R. at W. Enfield, Me. | 6,670 | 1901-1972 | 23.60 | 11,590 | 153,000 1 May 1923 |
| Penobscot R. at Passadumkeag, Me. | 7,000 | 1938-1958 | 23.63 | 12,180 | 126,000 14 Apr 1946 |

a snow-covered basin. The storm had a maximum recorded precipitation of 5.3 inches at Millinocket. An isohyetal map of the 1923 storm is shown on plate B-2. The discharge of the 1923 flood at the Bangor Hydroelectric Company dam in Old Town and for all other floods since 1918, are listed in table B-5.

7. FLOOD FREQUENCY

A flood frequency analysis was made using discharge records of the Penobscot River at the Milford plant of the Bangor Hydroelectric Company. Analysis was made using a log Pearson Type III distribution with annual peak discharges for each water year of record, 1 October to 30 September. Computations were made in accordance with procedures described in Water Resources Council Bulletin 15, "A Uniform Technique for Determining Floodflow Frequencies," dated December 1967, and also in, "Statistical Methods in Hydrology," dated January 1962 and cited in the Corps of Engineers EM 1110-2-1450. The mean log and standard deviation of the annual flows were 4.610 and .155, respectively. A skew coefficient of 0.0 was adopted, based on the 56-year period of record. The derived discharge stage frequency curve is shown on plate B-3.

8. STAGE-DISCHARGE RELATION

A stage-discharge relation for the Milford Dam, located about 2,000 feet downstream from Indian Island, is shown on plate B-4. This discharge rating plus the following pertinent data on the dam was supplied by the Bangor Hydroelectric Company.

| | |
|--------------------------|------------------|
| Date Built | 1906 |
| Type | Concrete Gravity |
| Purpose | Power |
| Spillway Length | 976 feet |
| Spillway Crest Elevation | 97.2 feet msl |
| Top of Flashboards | 101.6± feet msl |
| Normal Operating Stage | 102.0± feet msl |

9. UNIT HYDROGRAPH ANALYSIS

A unit hydrograph was developed for the Penobscot River at Passadumkeag, Maine, approximately 17 miles upstream from Indian Island, by analysis of the November 1950 flood. The unit graph was derived for use in estimating a non-snowmelt standard project flood discharge

TABLE B-5

PEAK ANNUAL DISCHARGES AT
THE MILFORD DAM OF THE BANGOR
HYDROELECTRIC COMPANY
2,000 FEET DOWNSTREAM FROM
INDIAN ISLAND

| <u>Date</u> | <u>Discharge</u> | <u>Date</u> | <u>Discharge</u> |
|-------------|------------------|-------------|------------------|
| 2 May 1918 | 29,800 | 28 Apr 1946 | 35,200 |
| 14 Apr 1919 | 30,000 | 8 May 1947 | 53,300 |
| 26 Apr 1920 | 40,000 | 20 May 1948 | 43,400 |
| 29 Mar 1921 | 36,300 | 20 Apr 1949 | 23,200 |
| 23 Jun 1922 | 45,200 | 23 Apr 1950 | 54,600 |
| 1 May 1923 | 103,000* | 5 Apr 1951 | 55,300 |
| 3 May 1924 | 38,500 | 22 Apr 1952 | 50,600 |
| 4 Apr 1925 | 24,400 | 1 Apr 1953 | 63,700 |
| 5 May 1926 | 47,000 | 24 Apr 1954 | 57,400 |
| 25 Apr 1927 | 28,900 | 17 Apr 1955 | 64,400 |
| 27 May 1928 | 39,200 | 1 May 1956 | 34,400 |
| 5 May 1929 | 49,000 | 23 Apr 1957 | 21,600 |
| 9 Apr 1930 | 37,000 | 24 Apr 1958 | 67,500 |
| 11 Jun 1931 | 30,100 | 21 Jun 1959 | 31,000 |
| 13 Apr 1932 | 46,100 | 15 May 1960 | 39,900 |
| 19 Apr 1933 | 40,600 | 30 May 1961 | 55,700 |
| 21 Apr 1934 | 58,100 | 10 Apr 1962 | 29,300 |
| 23 Apr 1935 | 45,600 | 3 May 1963 | 44,100 |
| 21 Mar 1936 | 87,500 | 16 Apr 1964 | 39,000 |
| 22 May 1937 | 35,200 | 18 Apr 1965 | 21,300 |
| 22 Apr 1938 | 31,400 | 27 Mar 1966 | 24,700 |
| 11 May 1939 | 37,400 | 14 May 1967 | 22,600 |
| 15 Apr 1940 | 69,200 | 26 Apr 1968 | 31,300 |
| 17 Apr 1941 | 31,100 | 20 Apr 1969 | 50,100 |
| 27 Apr 1942 | 40,600 | 27 Apr 1970 | 45,400 |
| 14 May 1943 | 32,300 | 6 May 1971 | 54,800 |
| 6 May 1944 | 21,600 | 9 May 1972 | 45,900 |
| 6 Apr 1945 | 47,100 | 30 Apr 1973 | 75,000 |

*Flood of Record

at Indian Island. The total drainage area at Passadumkeag is 7,000 square miles as compared to 7,600 square miles at Old Town. In November 1950, an average of 4.6 inches of rain fell over the basin in a 4-day period resulting in 2.1 inches of runoff with a peak runoff rate of 96,000 cfs at Passadumkeag.

A unit hydrograph was derived using HEC computer program, "Unit Hydrograph and Loss Rate Optimization." Pertinent data on the 12-hour unit hydrograph is presented in table B-6.

TABLE B-6

12-HOUR UNIT HYDROGRAPH - PERTINENT DATA

Penobscot River at
Passadumkeag, Maine
Pertinent Data

| | |
|------------------------------|--------|
| DA (sq. mi.) | 7,000 |
| T _p (hr.) | 49.8 |
| q _p (cfs/sq. mi.) | 7.06 |
| Q (cfs) | 49,430 |

10. STANDARD PROJECT STORM RAINFALL

A standard project storm rainfall for the Penobscot basin at Old Town was determined using Civil Works Engineer Bulletin 52-8, entitled: "Standard Project Flood Determination." The total SPS rainfall for a 72-hour duration was 7.22 inches or 36 percent greater than the May 1923 storm total of 5.3 inches.

11. STANDARD PROJECT FLOOD

Assuming an infiltration rate of 0.1 inch per hour, the SPS excess rainfall of 3.7 inches was applied to the unit hydrograph to develop the standard project flood at Passadumkeag. The resulting peak discharge was 183,000 cfs. This peak discharge was then increased

by 2 percent to correct for the difference in drainage areas between Passadumkeag and Old Town.

As shown on the basin map, Old Town, Maine, is actually an island in the Penobscot River and Indian Island is located in the left channel of that island. By analysis of past floods in the area, it was determined that approximately two-thirds of the Penobscot River discharge passes through the left channel and by Indian Island; therefore, the peak discharge in the left channel for the standard project flood at Indian Island is approximately 125,000 cfs or 21 percent greater than the 1923 flood of record. The SPF discharge of 125,000 cfs would produce a peak stage of 109.0 feet msl at the south end of Indian Island.

The occurrence of a standard project storm in the spring of the year during optimum snowmelt conditions could conceivably result in a flood on the Penobscot greater than the non-snowmelt SPF. It is estimated that the discharge of such a snowmelt flood might be as much as 20 percent greater than the non-snowmelt flood. It is considered, however, that a standard project type storm would be most probable during the summer and fall seasons and also the runoff resulting from rainfall on snow is dependent on antecedent snow density and concurrent temperatures. It was concluded that, though an SPF storm coincident with optimum snowmelt conditions is possible, it is very remote.

12. PREVIOUS TEMPORARY IMPROVEMENTS

Emergency flood control works of a temporary nature were constructed on Indian Island by the Corps of Engineers in the spring of 1971, to protect against a high flood potential as a result of above normal snow cover. The work was performed as part of Operation Foresight and was authorized under Public Law 99.

The emergency work consisted of the construction of approximately 700 linear feet of earthen dike on the easterly side of the Island and 540 linear feet on the westerly side. The dikes were built to a top elevation of 108.0 feet msl and had a top width of 8 feet. Included were six flap gated 12-inch diameter corrugated metal gravity drains through the line of protection for the relief of interior drainage. Approximately twenty homes and the main road to the Island were protected by this plan.

This past spring, on 30 April 1973, Indian Island was again threatened by high stages in the Penobscot River resulting from about 2.5 to 3 inches of rainfall over the basin during the snowmelt season. Emergency sandbagging was required at several points along the line of protection due to earlier deterioration of the temporary dikes and flap gate structures. Portable pumps were utilized to alleviate interior flooding, however, moderate flooding was experienced throughout the area before emergency measures were initiated. The peak stage recorded at the Milford Dam was 106.75 feet msl which has a frequency of approximately once in twenty-five years.

13. PRESENT PLAN OF IMPROVEMENTS

The present plan of improvements for Indian Island consists of raising and reconstructing the temporary dikes into more permanent structures. The top width will be increased to 12 feet and the top elevation to 110.0 feet msl. The side slopes will be increased to 2 horizontal on 1 vertical on the riverside and 4 horizontal on 1 vertical on the landside. Portable pumps will be used to discharge interior drainage during high river stages and gravity drains will be installed for passage of interior drainage during normal river stages.

14. DESIGN HEIGHT OF PROTECTION

The permanent dikes will be built to elevation 110.0 feet msl, providing 2.7 feet of freeboard above the 1923 record flood elevation of 107.3 feet msl and 1 foot of freeboard above the SPF level of 109.0 feet msl. The adopted level of protection was the result of weighing what was considered the minimum reasonable height versus the maximum economically justifiable level. The frequency of the record flood level of 107.3 feet msl based on statistical analysis of past floods, is approximately 200 years.

Ice jams are a frequent flood threat on the Penobscot River in the Old Town area. Such jams generally occur during moderate rises in riverflow or during the beginning of a major rise in flow. During major rises in flow, however, ice jams normally become dislodged prior to the occurrence of peak flow and the resulting peak river stage is unaffected by ice. Therefore, no special freeboard allowance was provided in design, over and above the 2.7 feet above record flood stage.

15. INTERIOR DRAINAGE

a. General. Drainage from approximately 10 acres is intercepted by the two dikes. Presently, there are six 12-inch diameter flap-gated corrugated metal pipes through the temporary line of protection for the relief of interior drainage. The flap gates have not been reliable and these drains are to be replaced with two 18-inch diameter drains equipped with positive closure gates. Portable pumps will be provided for pumping interior drainage during periods of high river stage.

b. Rainfall. Rainfall frequency data for the Old Town area, shown on table B-7, was obtained from "Rainfall Frequency Atlas of the United States, Technical Paper 40," U.S. Weather Bureau, May 1961.

c. Runoff. The interior drainage area is mostly undeveloped land with an average slope of about 1 percent. Interior runoff was computed using the rational formula with an adopted "C" of 0.3 and a time of concentration of 10 minutes. The runoff ratio resulting from various frequency rainfalls are listed in table B-7.

TABLE B-7

INTERIOR DRAINAGE DISCHARGES

DA = 10 acres

"C" = 0.3

"T_c" = 10 minutes

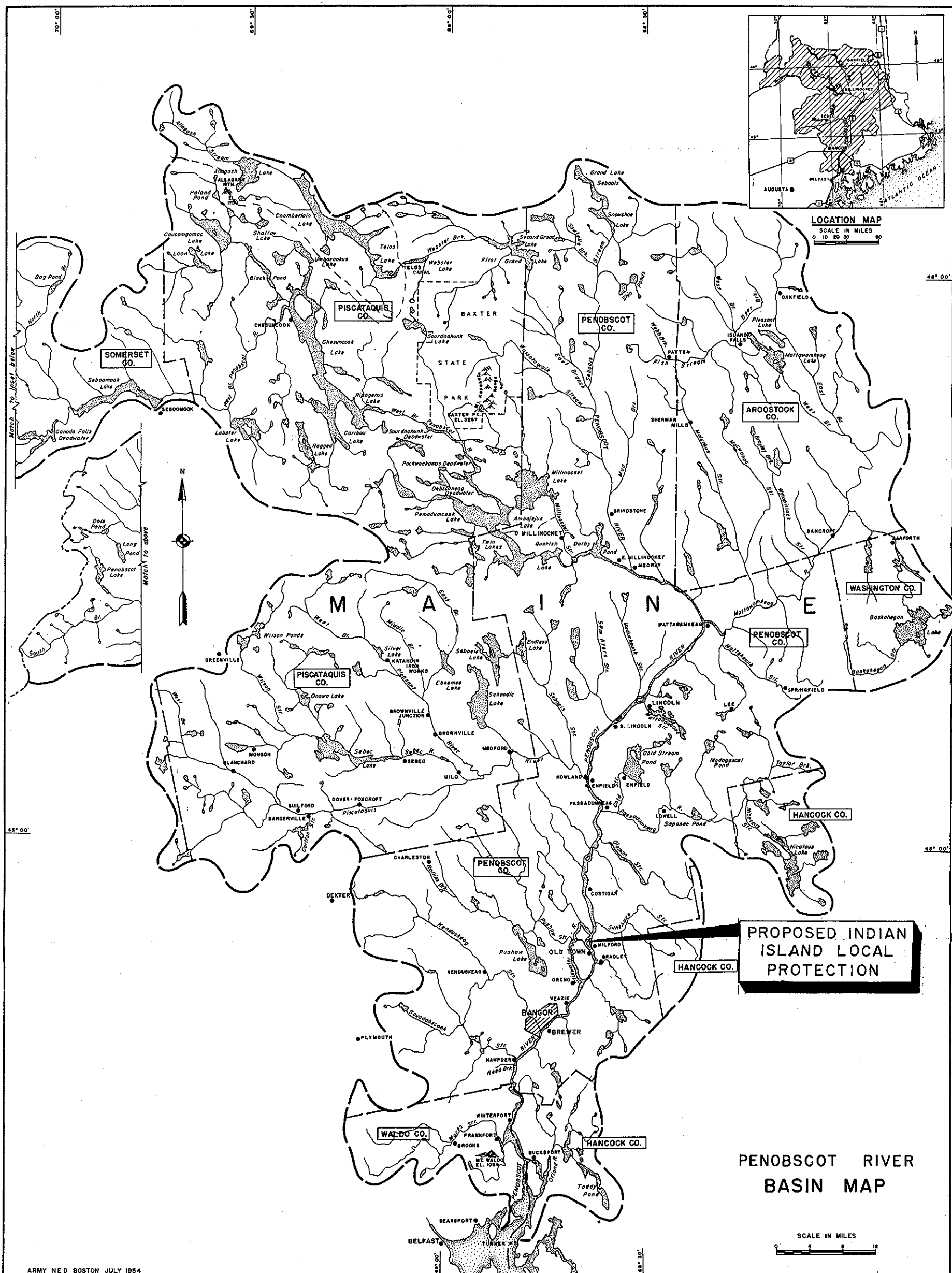
| <u>Frequency</u> <u>(years)</u> | <u>I</u> <u>(iph)</u> | <u>Q</u> <u>(cfs)</u> |
|------------------------------------|--------------------------|--------------------------|
| 1 | 2.0 | 6 |
| 2 | 2.6 | 7 |
| 5 | 3.4 | 10 |
| 10 | 4.1 | 12 |
| 25 | 4.8 | 14 |
| 50 | 5.5 | 16 |
| 100 | 6.0 | 18 |

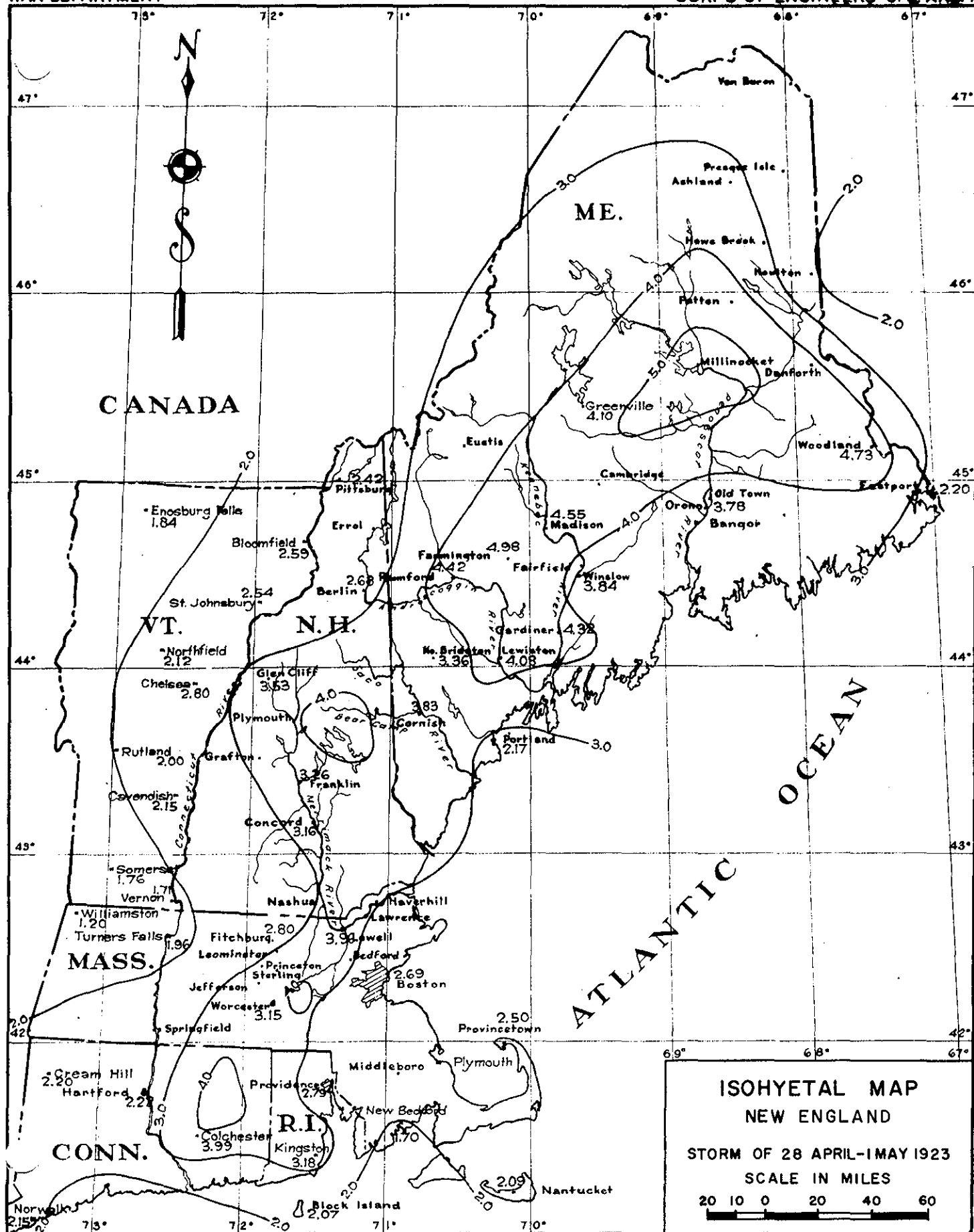
d. Ponding. As part of local assurances, the low interior area of about one acre below elevation 105 feet msl will be preserved for temporary ponding of interior runoff during times of high intensity runoff and to provide time for pump activation. It will also be requested that first floor grades of new construction be above elevation 106.0 feet msl. Ponding levels A, B and C, referred to in EM 1110-2-1410, are considered to be at elevations 104.0, 105.0 and 106.0 feet msl, respectively. Plate B-5 presents area-capacity curves and ponding elevation versus pumping capacity for various frequency storms within the protected area.

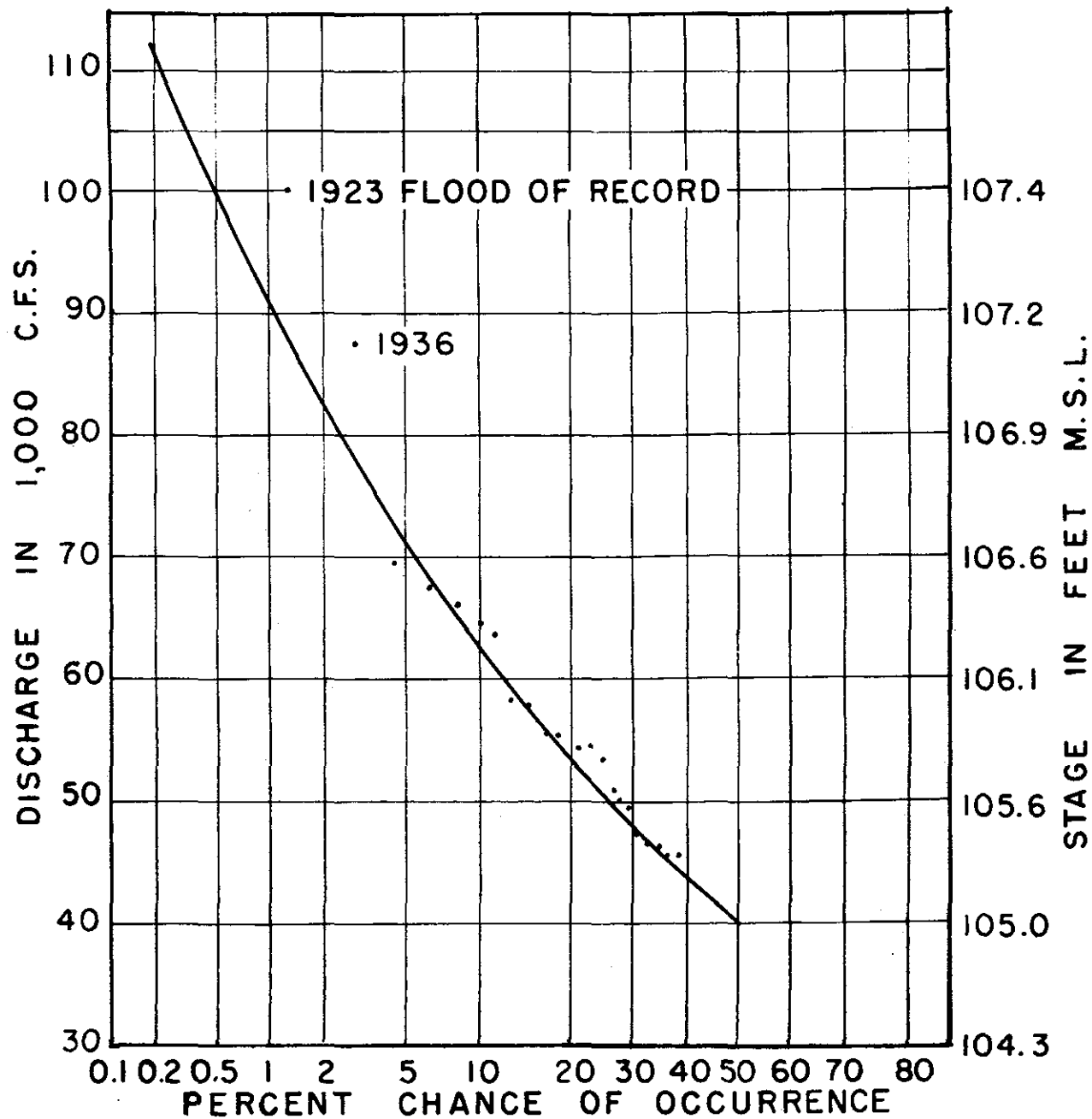
e. Pumping capacity. Two portable, self-priming, centrifugal pumps with a combined capacity of 4 cfs at an operating head of 10 feet will be provided for discharging interior drainage during high river stages. A capacity of 4 cfs is equivalent to an interior runoff rate of 0.4 inch per hour from the 10 acres of contributing area. This pumping capacity would theoretically maintain the level of ponding below elevation 106 during a 10-year frequency 12-hour storm rainfall, assuming a rainfall loss rate of 0.1 inch per hour. Ponding levels versus pumping capacity for various frequency rainfall runoffs are shown on plate B-5.

f. Coincident river stages. Annual peak stages on the Penobscot have historically occurred in the spring months of March, April and May. The probability of high intensity rainfall over the interior area is less in the spring than in the summer and fall seasons, therefore, the probability of intense rainfall coincident with a high river stage is quite remote.

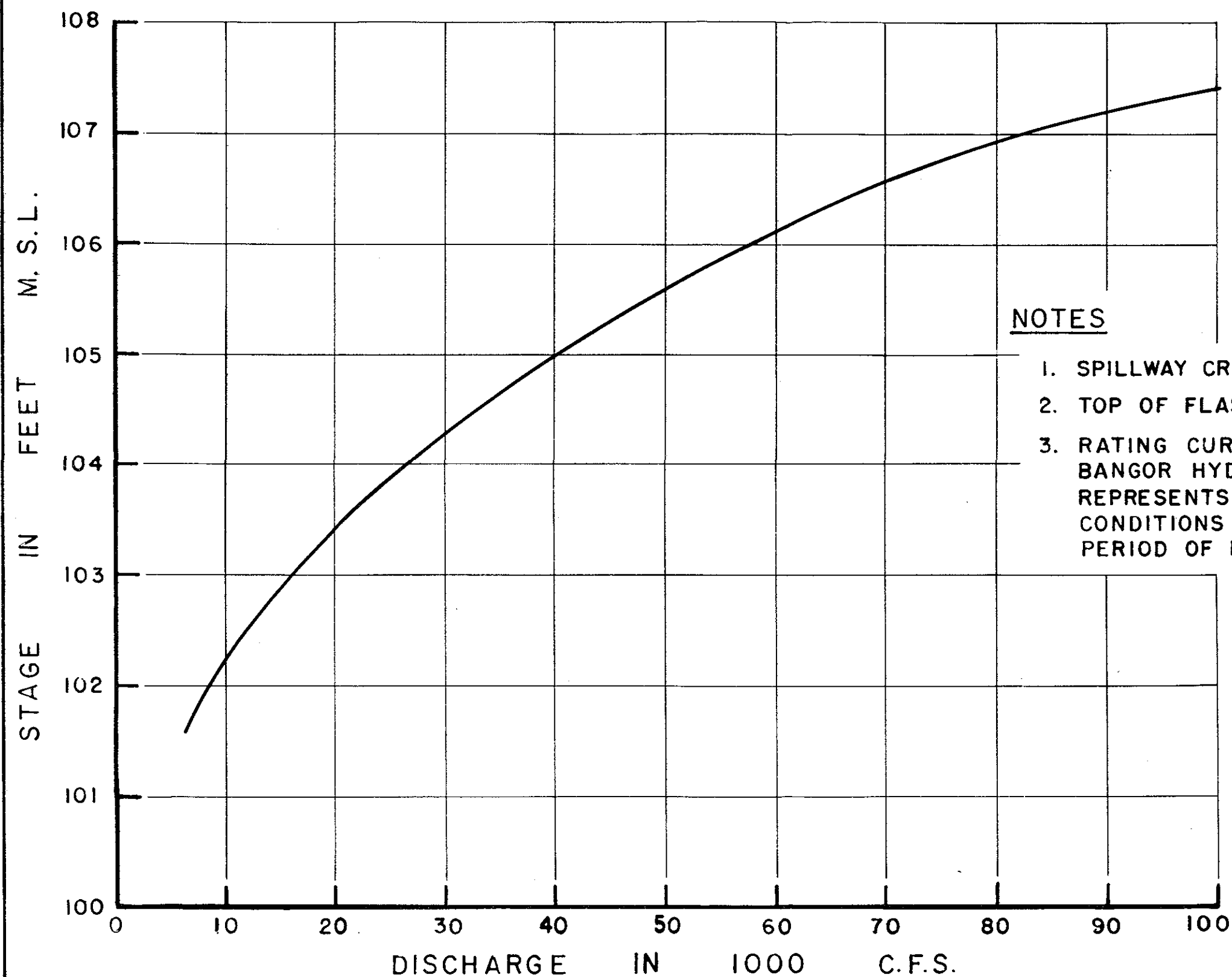
g. Gravity drains. The existing corrugated metal gravity drains will be replaced with two 18-inch diameter drains. With a hydraulic head differential of 2 feet, these drains will have a combined capacity of 30 cfs, equivalent to a runoff rate of 3.0 inches per hour. Each drain will be equipped with a shear gate providing a means of positive closure. Flap-type service gates will also be installed to prevent flooding from high river stages.







INDIAN ISLAND
OLD TOWN, MAINE
PENOBSCOT RIVER
STAGE-DISCHARGE-FREQUENCY
CURVE



NOTES

1. SPILLWAY CREST AT EL. 97.2 FT. M.S.L.
2. TOP OF FLASHBOARDS 101.6 \pm FT. M.S.L.
3. RATING CURVE SUPPLIED BY BANGOR HYDRO ELECTRIC CO. AND REPRESENTS AVERAGE STAGE DISCHARGE CONDITIONS OVER A FORTY YEAR PERIOD OF RECORD.

PENOBSCOT RIVER FLOOD CONTROL
INDIAN ISLAND LOCAL PROTECTION
PROJECT

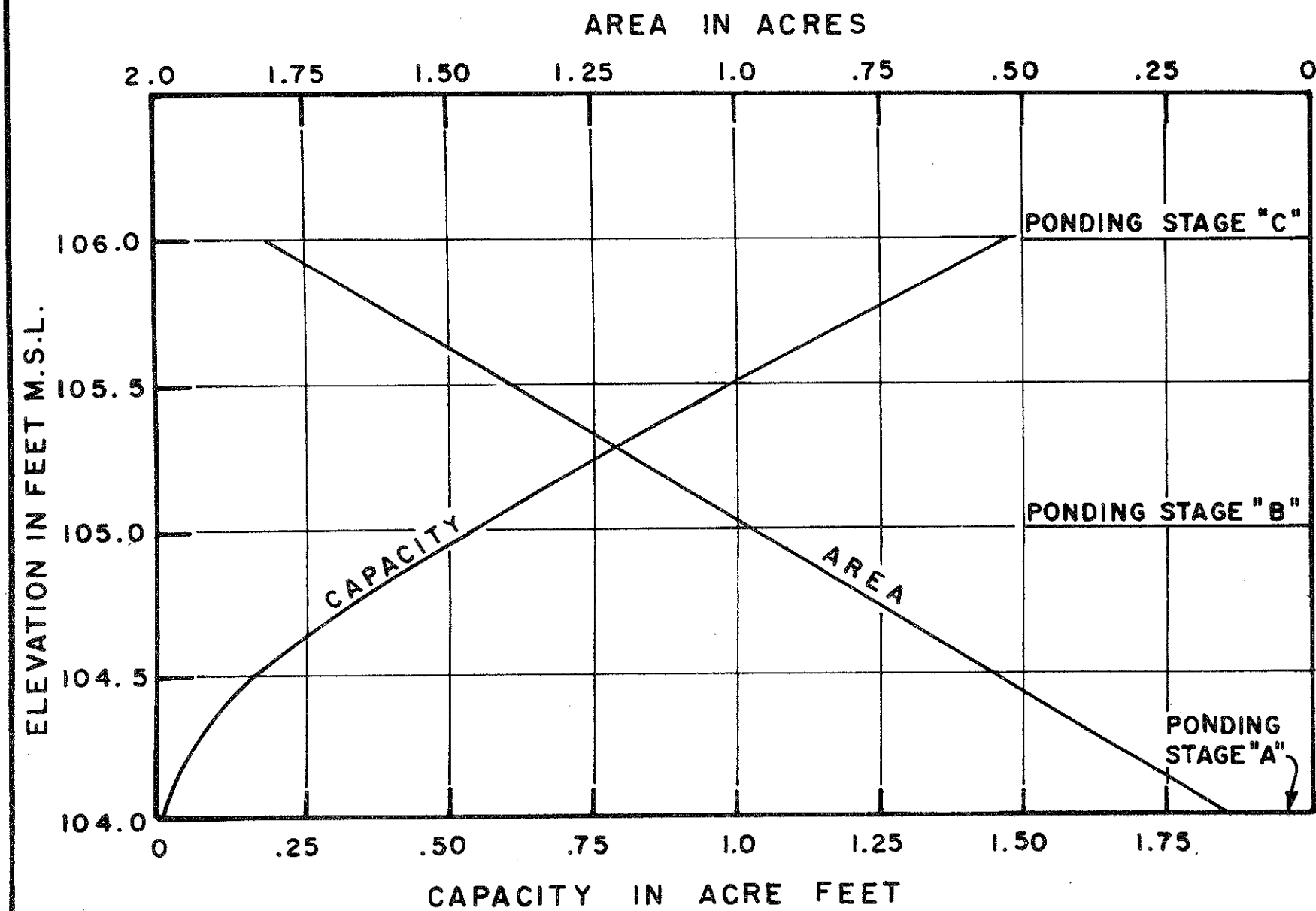
STAGE VS DISCHARGE
CURVE

MILFORD DAM

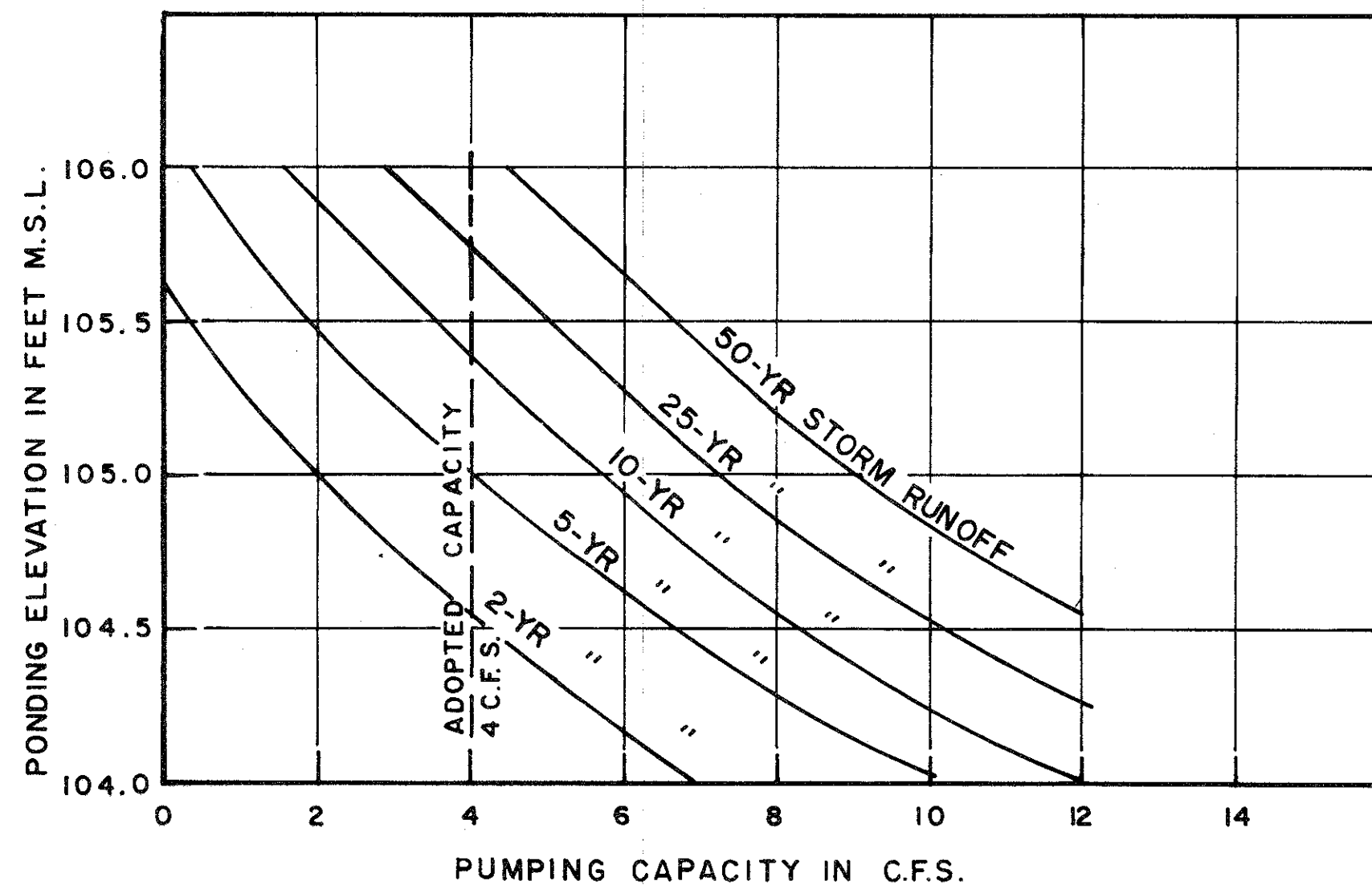
OLD TOWN, ME.

OCT. 1973

PLATE B-4



AREA - CAPACITY CURVES



PONDING ELEVATION VS PUMP CAPACITY

PENOBSCOT RIVER FLOOD CONTROL
 OLD TOWN, MAINE
 INDIAN ISLAND
 LOCAL PROTECTION
 INTERIOR DRAINAGE HYDROLOGY

APPENDIX C

DIGEST OF PUBLIC MEETING

APPENDIX C

DIGEST OF PUBLIC MEETING - 23 JANUARY 1973

| <u>Speaker</u> | <u>Interest Represented</u> | <u>Remarks</u> |
|--|---|---|
| Mr. Charles L. Boothby, Executive Director | Soil and Water Conservation Commission, State of Maine | Speaking on behalf of the State of Maine, questioned the procedure involved in obtaining land for the project. |
| Mr. John Stevens, Commissioner | Department of Indian Affairs, State of Maine | Speaking on behalf of the Depart- ment of Indian Affairs, endorses the project but questioned the cost of maintaining the dikes. |
| Mr. Obie D. Ashford, District Conservationist | U. S. Department of Agriculture, Soil Conservation Service | Supplied data relative to soil analy- sis conducted by the Soil Conservation Service. |
| Mr. Matthew Sappier, Governor | Penobscot Indian Tribe | Would like to see the temporary dikes incorporated into a permanent flood control project. |
| Mr. Wilfred Pehrson, Member | Penobscot Indian Tribal Council | Endorses the project and will assist in any way possible. |
| Mr. Sappier | Resident of Indian Island | Questioned the effectiveness of the interior drainage facilities. |

| <u>Speaker</u> | <u>Interest Represented</u> | <u>Remarks</u> |
|--------------------------------|-----------------------------|---|
| Mr. Michael Ranco, Director | Community Action Program | In favor of the project, but would like to see the dike located further into the river (Note: Increased costs would prohibit this relocation). |
| Mr. James Sappier | Resident of Indian Island | Stated that there is a proposed sewer system for the island and is concerned that these sewers lines will go through the dikes. (Note: we have been in contact with the firm designing the sewer system and no sewer lines will go through the proposed dikes). |

APPENDIX D
PRINCIPLES AND STANDARDS

APPENDIX D

PRINCIPLES AND STANDARDS

INDIAN ISLAND LOCAL PROTECTION

PENOBSCOT RIVER

OLD TOWN, MAINE

| | <u>Current Applicable Rate</u> | <u>Principals and Standards</u> ¹ |
|-----------------|--|--|
| Interest Rate | 5-5/8% | 6-7/8% |
| BCR | 1.32 | 1.13 |
| Annual Costs | \$6,716 | \$7,890 |
| Annual Benefits | \$8,900 | \$8,900 |

¹ There are no old or new General Recreation Day Unit Values for this project.

The proposed project will not have significant adverse affects on the environment, and there are no controversial issues involved.